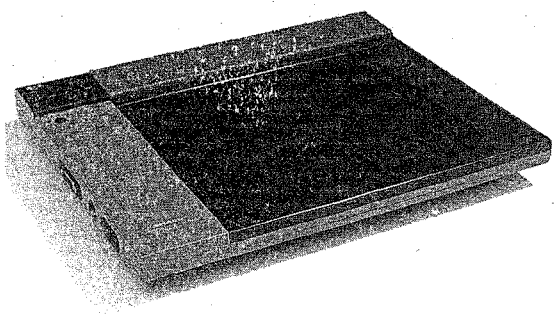
SHARP SERVICE MANUAL

S1106QA-1000/



COMPUTER PROJECTION PANEL

MODEL QA-1000

In the interests of user-safety (Required by safety regulation in some countries), the set should be restored to its original condition and only parts identical to those specified should be used.

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SHARP CORPORATION

INTRODUCTION

COMPUTER PROJECTION PANEL displays images generated on a personal computer onto a large screen or wall, using an overhead projector as the light source.

QA-1000 employs 10.4 inches TFT (Thin Film Transistor) 640 × 480 dot color liquid crystal display (LCD). It is designed so that the heat generated by OHP is exhausted from the computer projection panel by a fan motor not to increase the temperature of LCD extremely. Approximately DC 12V is supplied as a power source externally through AC adaptor.

SPECIFICATIONS

1. SPECIFICATIONS OF MAIN BODY

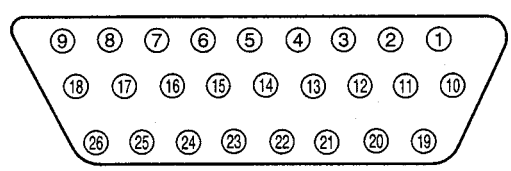
1.	Display unit	: 10.4 inches TFT color LCD
2.	Color	: 64 colors
3.	Contrast ratio	: 60 : 1
4.	Character display area	: Max. about 211.2 × 158.4mm
5.	Dot arrangement	: R, G, B, vertical stripe
6.	Number of display dots	: 640(W) × RGB × 480(H) dots
7.	Dot pitch	: 0.11(H) × 0.33(V)mm
8.	Input video signal	: TTL level – R, G, B, r, g, b, I, Hsync, Vsync or Analog level – VGA signal for IBM PS/2 or Analog level – APPLE MAC II video card signal
9.	I/O connection port	: Video signal input connector (1) DC power input connector (1)
10.	Switch	: DC power ON/OFF switch Function switches (4) Threshold adjustment volume (1)
11.	Function	: Horizontal/vertical adjustment of image position Phase adjustment Software RESET Input video signal automatic discrimination Adjusted condition retaining function Frequency adjustment
12.	Dimensions	: 385(W) × 50(H) × 318.5(D)mm
13.	Net weight	: Approx. 3kg
14.	Others	: Display surface cooling ventilation (Including a built-in fan motor for forced air-cooling)

2. SPECIFICATIONS OF INTERFACE

2.1. Video signal input selection

Input signal layout :

① Digital Secondary Green (g, I)
② Digital Secondary Blue (b, Video)
③ Digital Secondary Red (r)
④ Analog Blue
⑤ Analog Green
⑥ Analog Red
⑦ Digital GND
⑧ Test 1 (MAC II)
⑨ N.C.
⑩ Digital Green
⑪ Digital Red
⑫ Digital Blue
⑬ Analog Blue Return
⑭ Analog Green Return
⑮ Analog Red Return
⑯ Digital GND
⑰ N.C.
⑱ N.C.
⑲ Vsync (Digital)
⑳ Hsync/Csync (Digital)
㉑ N.C.
㉒ N.C.
㉓ Digital GND
㉔ Digital GND
㉕ Digital GND
㉖ N.C.



Connector : Subminiature D 26-pin connector
AMP 748481-6 (applicable plug housing is AMP 748365-1), JST KAY-26S-2A3F14 (applicable plug housing is JST KAC-26P), or equivalent ones.

TEST 1 terminal : Pin 8 must be set to LOW (GND) for analog APPLE MAC II video card signal input, and to open (N.C.) for other signal input.

✻ It is impossible to use digital video signal input (①, ②, ③, ⑩, ⑪, ⑫) and analog video signal input (④, ⑤, ⑥) simultaneously. The unused input must be kept open (N.C.).

2.2. Power input selection

Input terminal : Center pin + polarity

Input voltage : 12V DC (with main body under load.), 2.0A with supplied special AC adaptor.

3. SPECIFICATIONS OF ENVIRONMENT

Basically, these environmental specifications apply to the main body and its accessories.

Table 1

Item		Specification	Remarks
Operating environment	Operating temperature	0 to 30°C (The LCD surface temperature shall be 45°C or lower.)	No dew condensation
	Operating humidity	Ta $\leqq$ 40°C : 90% RH Ta $>$ 40°C : Absolute humidity shall be less than Ta = 40°C/ 90% RH (Ta : Temperature of the LCD)	
Storing environment	Storage temperature	−20 to 60°C	
	Storage humidity	Same as the operating humidity condition	

ADJUSTMENT OF P.W.B.

1. ADJUSTMENT OF LCD UNIT CONTROL P.W.B.

This unit involves four adjusting points: VR1 to vary the reference voltage for A/D conversion of analog video signals; VR2 to vary the internal power source V_{CPU} and V_C; VR3 to vary the internal power source V_{DD}; L6 to vary the operating point of High Band VCO; and L7 to vary the operating point of Low Band VCO.

This unit does not operate normally unless these points are adjusted properly. Adjustment is necessary when repair, maintenance, or parts replacement was performed.

Adjusting method is as explained below. Always adjust or check the +5V power source before adjusting VCO.

2. ADJUSTMENT OF +5V (V_{CPU}), +12V (V_{DD}) POWER SOURCE

1. Connect the AC adaptor connector plug to CN1.
   Check that the output of AC adaptor is approx. 12V.
2. Connect the ⊕ terminal of DC voltmeter to TP1 (D3 cathode side) and ⊖ terminal to GND (power switch fixing angle, etc.) for voltage measurement.
3. Check each part before turning the power SW ON.
   Set VR1, VR2 and VR3 to the center of variable range.
   Connect CN4 with SW. P.W.B. through a flexible cable.
   Connect CN2 with fan motor.
   Disconnect the flexible cable from CN5 to separate it from LCD unit.
   Presence and type of video signal input to CN3 are not specified.
   Check if a conductor on the back of P.W.B. is crushed, or if there is any foreign matter sticking.
4. Turn the power SW ON and check that the LED lights up and the fan begins rotating.
5. Rotate VR2 with a ⊖ driver and adjust to approx. 5.1V while checking the voltage on a voltmeter.
6. Turn the power switch OFF and connect the ⊕ terminal of the DC voltmeter to TP9.
7. Turn the power switch ON and rotate VR3 with a ⊖ driver to adjust to approx. 12.0V while checking the voltage on the voltmeter.
8. Turn power off. Caution, wait approx. 10 seconds or more before connecting LCD to CN5. Connect CN5 to LCD.
9. Turn the power ON again and make a fine adjustment to set the voltage of TP1 to 5.1V ± 0.08V and that of TP9 to 12.0V ± 0.08V three minutes after the turning on.

3. ADJUSTMENT OF VCO

1. Connect the ⊕ terminal of DC voltmeter to TP5 and the ⊖ terminal to GND (power SW fixing angle), connect the fan motor, LCD unit and SW P.W.B.
2. Input CGA video signal to CN3 according to the timing in the test pattern 1.
3. Turn the power SW ON and operate unit for three minutes.
4. Adjustment of VCO on Low Band side

   Adjust L7 by using a ceramic driver and set the voltage at TP5 to 2.5V ± 0.05V. (*1)
5. Input EGA video signal to CN3 according to the timing in the test pattern 2.
6. Adjustment of VCO on High Band side

   Rotate the core of L6 to adjust the voltage of TP5 to 2.5V ± 0.05V. (*1)

*1 (Voltage of TP5 may vary between when the adjustment driver is contact with the variable core and when it is away depending on the material of adjusting driver to be used. Adjust the voltage to be normal when it is away from the core.)

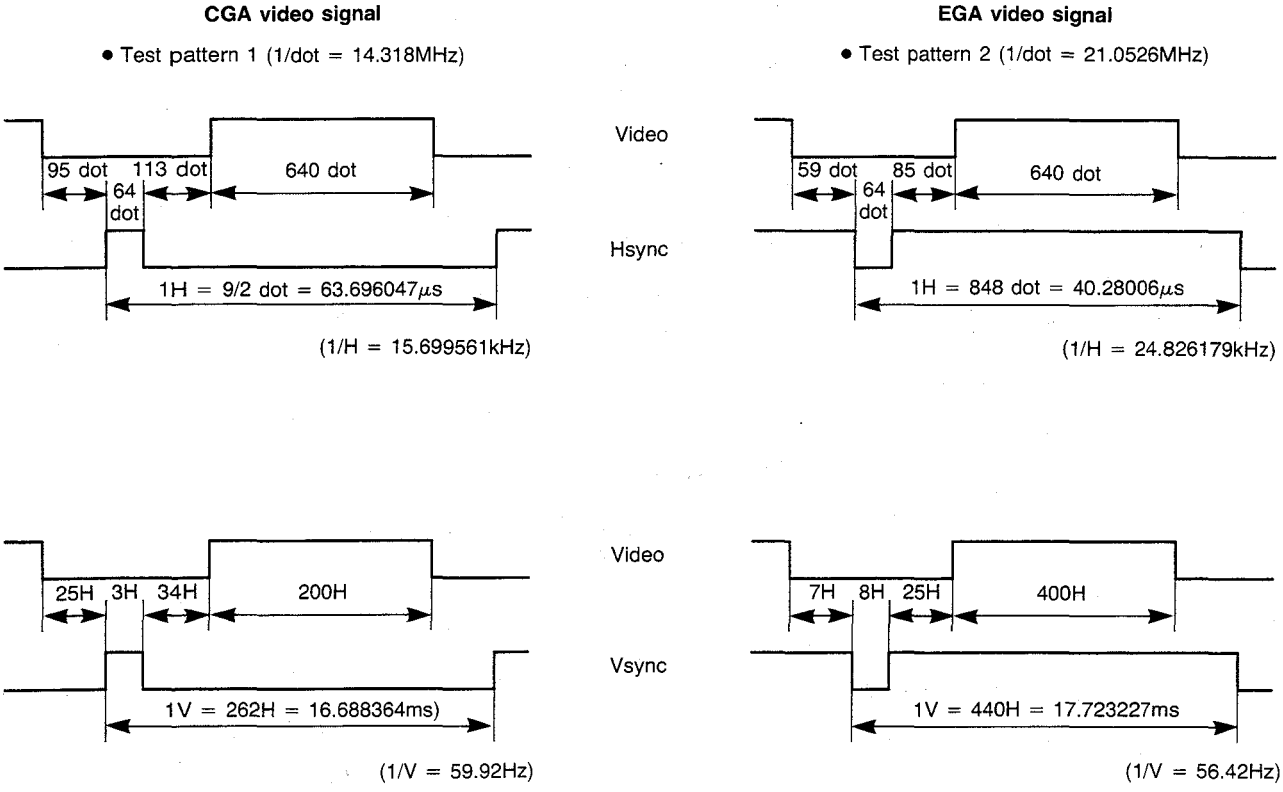


Fig. 1

CIRCUIT DESCRIPTION

1. GENERAL

Circuits will be described in reference to the QA-1000 BLOCK DIAGRAM shown in Fig. 2.

The analog RGB signal from the computer, IBM PS/2 (VGA) or APPLE MAC II, passes through a dedicated cable (optional for APPLE MAC II) and 26-pin input connector (CN3), enters the analog input circuit, and converted to a digital RGB signal (PR, PG, PB, SR, SG, and SB).

The digital signal from an IBM-PC EGA or IBM-PC CGA passes through a dedicated cable and 26-pin input connector (CN3) and enters the digital input circuit.

The input selector consisting of NAND circuits selects one of the above as the valid RGB signal and sends it to the field memory (IC3, 4, 5 and 6) in the form PR, PG, PB, SR, SG, and SB.

Writing into the field memory (IC3, 4, 5, and 6) is controlled by signals SWCK, UWE, LWE, URSTW, and LRSTW created from HSYNC and VSYNC in IC1, and digital signals PR, PG, PB, SR, SG, and SB are stored in the field memory. However, for the APPLE MAC II, SWCK, UEW, LWE, URSTW, and LRSTW signals are generated from Csync signal. (See MAC II synchronizing signal separator.)

To improve display quality of LCD, the screen is divided into the upper and lower halves. Video signals for the upper half of the screen are stored in IC3, 4 of the field memory, and that for the lower half, in IC5, 6.

PLL (phase-locked loop) circuit, consisting of a phase detector, 1/N divider, LF (loop filter), and VCO (voltage-controlled oscillator), is used to generate a dot clock from Hsync (Csync for MAC II) signal.

The LCD control is asynchronous from the computer signals.

Video signals (PR, PG, PB, SR, SG, and SB) sent from the computer are first written into the field memory. To read out video data according to display timing of the LCD UNIT, the AND BUFFER, HBL GENERATOR and VBL GENERATOR CIRCUITs generate field memory read-out signals.

The video data read from the field memory is converted into LCD UNIT display data DR0-2, DG0-2, and DB0-2 through logical operation carried out by the COLOR SIGNALS GENERATOR CIRCUIT.

IC2 (M.P.U.) is an 8-bit one-chip microcomputer that controls IC1 via key entry.

IC2 receives divider signals for HSYNC and VSYNC, and polarity signals from DIVIDER FOR AUTOMATIC SET UP on IC1 and discriminates between the types of personal computers connected. According to the discriminated type, it outputs signals that control IC1's operation.

Thus it feeds back appropriate signals to IC1 and selects an appropriate VCO according to the type of personal computer. IC2 has an EEPROM. The control data altered by key entry is stored in the EEPROM, which remains if the power is turned off.

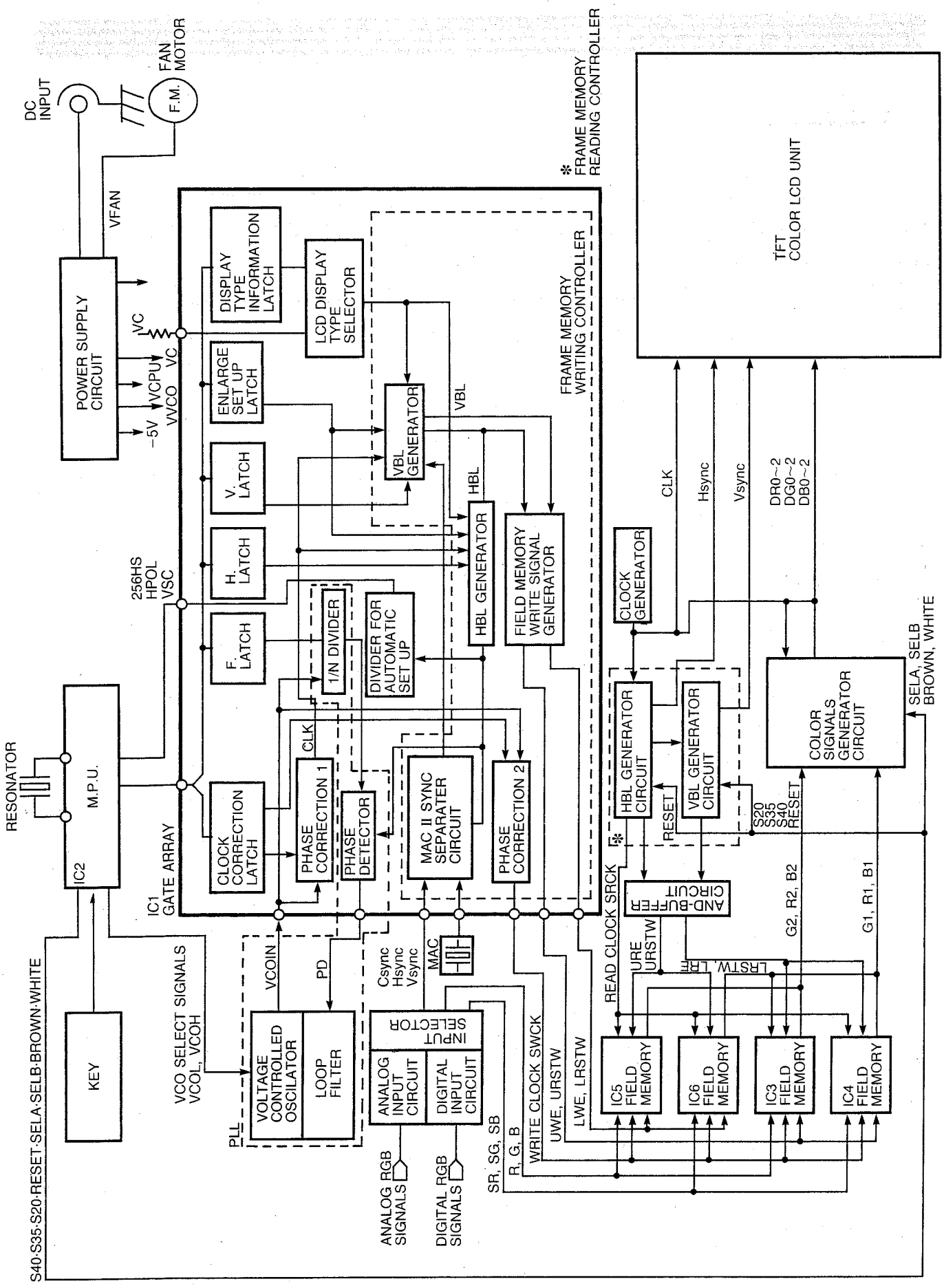


Fig. 2 QA-1000 BLOCK DIAGRAM

2. VIDEO SIGNAL INPUT CIRCUITS

The QA-1000 accepts two types of video signals: Analog signals from IBM PS/2 and APPLE MAC II; and digital signals from IBM PC/AT/XT's MDA, CGA, and EGA. These signals are supplied through a 26-pin connector (CN3), then to the analog video input circuit or the digital video input circuit. The following description refers to Fig. 3.

2.1. Digital video signal selection

Digital video signals enter pins 12, 2, 11, 3, 10, and 1 on CN3 and are inverted by an INVERTOR in IC23. NAND operation for the inverted digital signals and analog signals are carried out by IC24, 25, and 26, which output PR, PG, PB, SR, SG, and SB.

Since the analog signal lines described later are pulled down by R99, 100, 101, all analog signals inputted to NAND operator IC24, 25, and 26 are set to the high level when receiving digital signals.

The EGA outputs a 6-bit TTL level video signal. (R, G, B, r, g, b)

The CGA outputs a 4-bit TTL level video signal. (R, G, B, I)

The MDA outputs a 2-bit TTL level video signal. (Mono video, I)

Connector CN3's each pin basically carries the following signals.

Table 2

Video Signal	Connector CN3's Pin Number								
	1	2	3	10	11	12	19	20	24
EGA	g	b	r	G	R	B	Vsync	Hsync	GND
CGA	I	×	×	G	R	B	Vsync	Hsync	GND
MDA	I	Mono video	×	×	×	×	Vsync	Hsync	GND

× : Do not care or N.C.

2.2. Analog video signal input circuit

IBM PS/2 and APPLE MAC II have the following levels of video signal at a 75-Ohm load.

Table 3

	Video Signal		
	R	G	B
IBM PS/2	0.7Vp-p	0.7Vp-p	0.7Vp-p
APPLE MAC II	0.7Vp-p	1.0Vp-p (Synchronization signal overlapped)	0.7Vp-p

Each signal component is converted into a 2-bit digital code according to three threshold levels. The conversion is performed by comparators IC13 to IC21. Reference voltages are supplied to pins 2 of these ICs. The video signal is fed to pin 3 of each comparator. While the signal level is lower than the reference voltage, pin 7 indicates a low level. While the signal level higher than the reference voltage, pin 7 indicates a high level. The following table shows the three threshold levels, which are also adjustable by variable resistor VR2.

Table 4

Threshold Level		0.7Vp-p Video Signal	1.0Vp-p Video Signal
V_ℓ	Range (approx.)	0.11 ~ 0.20V	0.39 ~ 0.48V
	Typical value (approx.)	0.15V	0.43V
V_m	Range (approx.)	0.26 ~ 0.48V	0.54 ~ 0.76V
	Typical value (approx.)	0.35V	0.63V
V_h	Range (approx.)	0.41 ~ 0.75V	0.69 ~ 1.03V
	Typical value (approx.)	0.55V	0.86V

IC22, 24, 25, and 26 generate 2-bit digital signals (PR, PG, PB, SR, SG, and SB) from the comparators, according to the conditions shown in Table 4.

Since the digital signal lines described earlier are pulled down by R99, 100, 101, all analog signals inputted to NAND operator IC24, 25, and 26 are set to the high level when receiving analog signals.

2.3. Threshold level generator

The three threshold levels (V_ℓ, V_m, and V_h) for converting an analog video signal into a digital form differ for 0.7Vp-p and 1.0Vp-p signals. Since the APPLE MAC II's G-signal has 1.0Vp-p level, the threshold generator circuitry for this signal is slightly different from the other signals (R and B). The following table shows the relation between the basic threshold levels (V_ℓ, V_m, and V_h) and actual levels used for the signals (R, G, and B) in IBM PS/2 and APPLE MAC II in Fig. 3.

Table 5

Threshold	IBM PS/2			APPLE MAC II		
	R	G	B	R	G	B
V_ℓ	V_L	V_{LM} ($\fallingdotseq V_L$)	V_L	V_L	V_{LM} ($\fallingdotseq V_L + 0.28V$)	V_L
V_m	V_M	V_{MM} ($\fallingdotseq V_M$)	V_M	V_M	V_{MM} ($\fallingdotseq V_M + 0.28V$)	V_M
V_n	V_H	V_{HM} ($\fallingdotseq V_H$)	V_H	V_H	V_{HM} ($\fallingdotseq V_H + 0.28V$)	V_H

As Fig. 3 shows, 0.28V and V_H are generated based on reference voltage ZD LT1004C. In addition, V_M, V_L, V_{LM}, V_{MM}, and V_{HM} are generated based on 0.28V and V_H.

V_H is adjustable with variable resistor VR1, and varying V_H level varies all voltage values except 0.28V, in proportion to V_H.

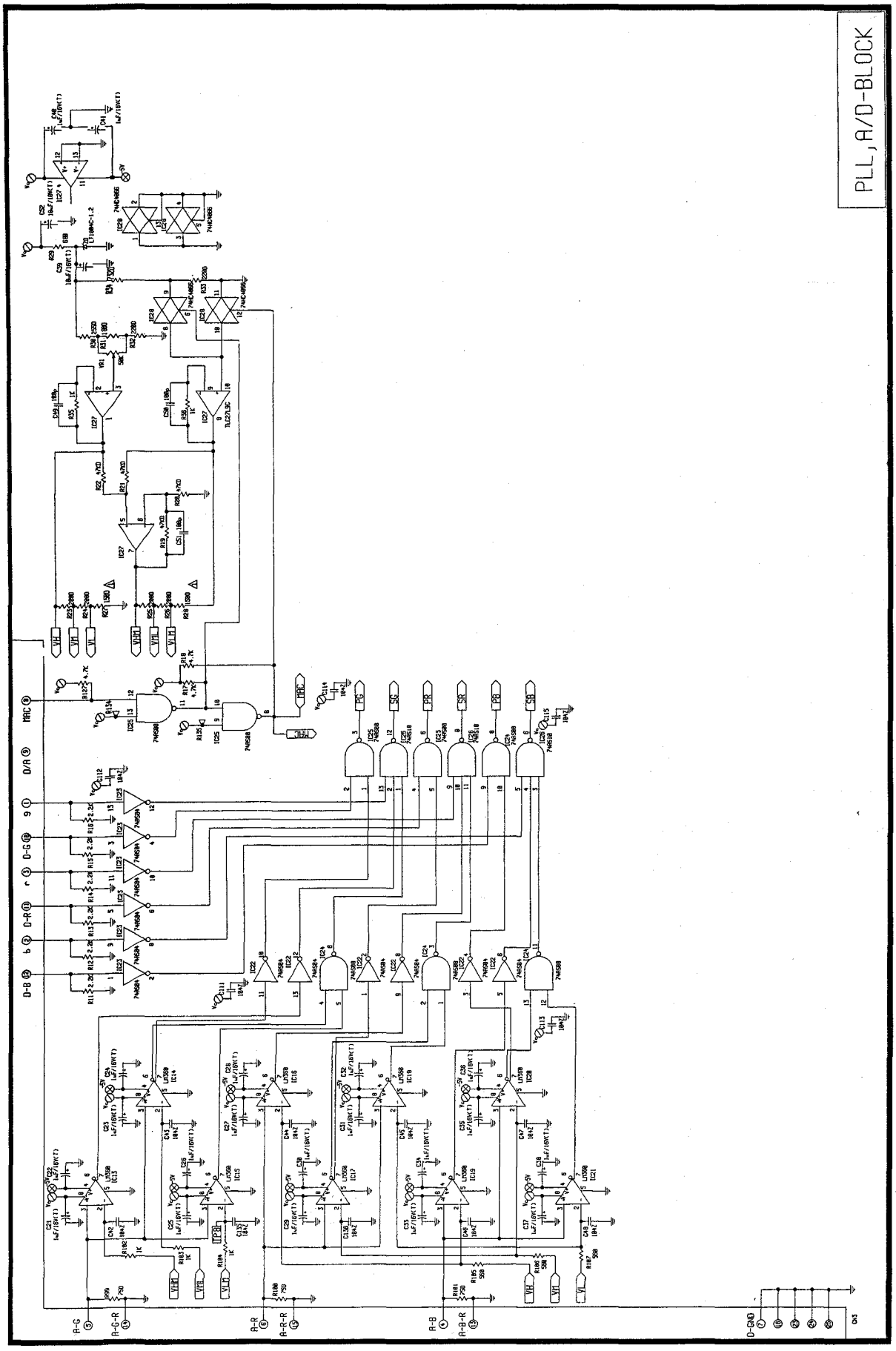


Fig. 3 VIDEO SIGNAL INPUT CIRCUIT

3. PLL CIRCUIT

A dot clock is required to sample a video signal from the computer and extract proper dot data. The dot clock, f_{ck}, is generated by the PLL circuit shown in Fig. 4.

The horizontal sync, f_H, is compared to the feedback signal, f_F, by the phase detector on IC1. If there is a phase or frequency difference in f_H and f_F signals, pin 120 (PDB) of IC1 goes either low or high level. If the phases and frequencies match, the PDB pin goes to high impedance. The output signal from the PDB pin is converted by a loop filter into a DC voltage, which controls the VCO.

There are two VCOs, IC10 and IC11 (both are SP1648). IC10 is for high frequency (20.8 to 30.24MHz) oscillation and IC11 is for low frequency (14.3 to 20.8MHz) oscillation. The capacitance of varactor diode (D7 or D8) and the inductance of coil (L6 or L7) determine the oscillating frequency.

The voltage applied to the varactor diode is changed to control the oscillating frequency.

Selection of high-band or low-band is made by a signal generated by amplifying current of signals from pin 58 (VCOH) and pin 57 (VCOL). Amplification is done by a driver (IC8), and one of two VCOs is activated.

The control voltage from the loop filter varies the VCO oscillating frequency in the direction that will compensate for the phase difference detected by the phase detector. The VCO output, f_{ck}, passes through IC12 (74HC00), enters pin 123 (VCOIN) of IC1, and has its frequency divided to 1/N by the 1/N variable divider to become feedback signal, f_F. This feedback signal enters the phase detector on IC1 and is compared to the horizontal sync, f_H.

By repeating the above loop, the VCO output, f_{CK}, entering from the VCOIN becomes a dot clock whose phase matches the horizontal sync, f_H and frequency is N times as f_H.

The setting value may also be controlled by key entry.

For the control procedure, select FREQ with the MODE SELECT switch and use MODE ADJ switch ◁ and ▷.

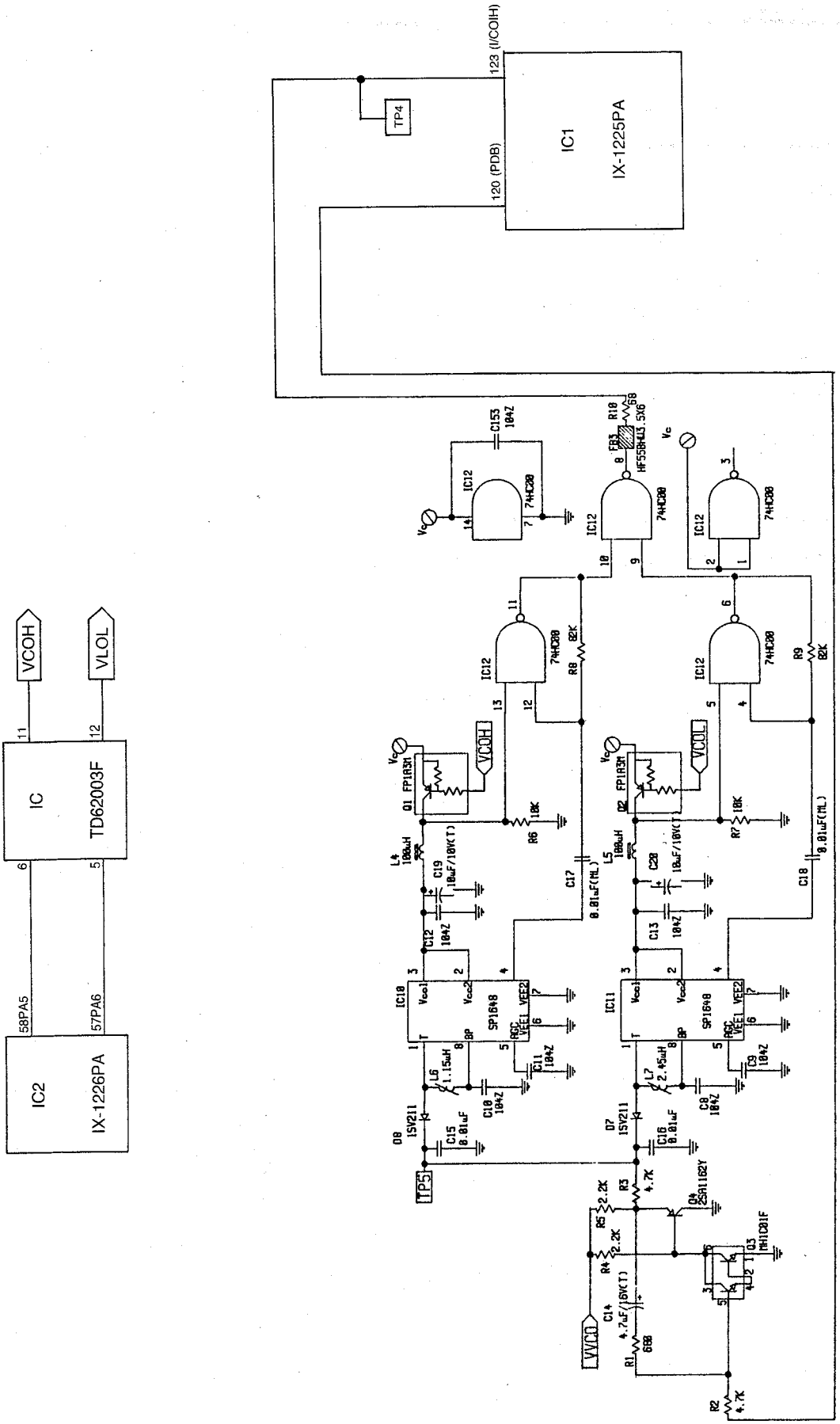


Fig. 4 PLL (Phase-Locked-Loop) CIRCUIT

4. PREPARATION OF HORIZONTAL BLANKING SIGNAL

Horizontal synchronizing signal f_H and video signal have a relation as shown in Fig. 5. Horizontal blanking signal HBL is prepared so that only the data required for display can be selected from the video signals.

The signal preparation circuit consists of an HBL GENERATOR and register H. LATCH, as shown in Fig. 2 "BLOCK DIAGRAM."

The period T_{hs}, from the leading edge of horizontal synchronizing signal f_H to the start of the horizontal display period is obtained by dot clock cycle $T_{CK} \times h$. The value of h is set into the H. LATCH on IC1.

The H. LATCH is controlled by IC2 (M.P.U.), whose value h may also be controlled by key entry. For the control procedure, select Hpos with the MODE SELECT switch and use MODE ADJ switch ◁ and ▷.

Corresponding to the varied h-value, display on the LCD moves in horizontal direction. Since the number of horizontal display dots is 640, the horizontal display time will be $640 \times T_{CK}$.

Note: Excessive shifting of horizontal position may cause drifting images on display.

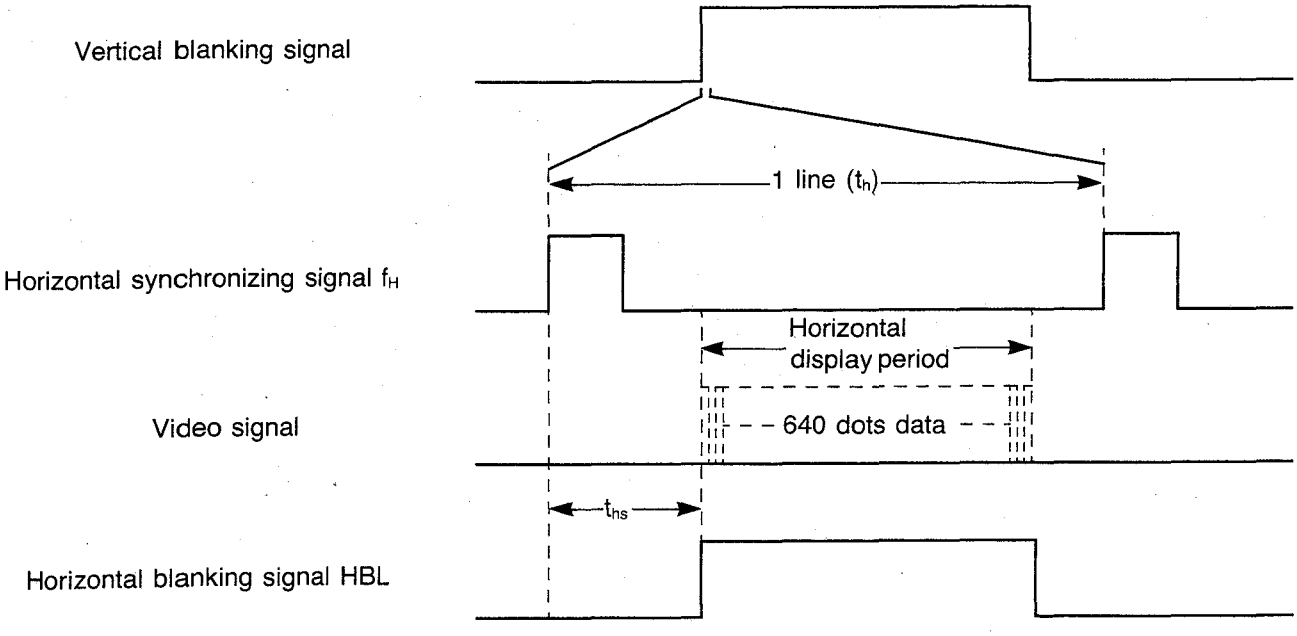


Fig. 5 HORIZONTAL BLANKING SIGNAL

5. PREPARATION OF VERTICAL BLANKING SIGNAL

The relation between vertical synchronizing signal f_V and video signal is as shown in Fig. 6. Preparation of vertical blanking signal VBL is to select only the data effective for display from video signal.

The circuit consists of a VBL GENERATOR and register V. LATCH, as shown in Fig. 2 "BLOCK DIAGRAM."

The period T_{vs}, from the leading edge of vertical synchronizing signal f_V to the start of the vertical display period is obtained by horizontal cycle $T_h \times v$. This v-value is set into the V. LATCH on IC1. The V. LATCH is controlled by IC2 (M.P.U.), whose value v may also be controlled by key entry. For the control procedure, select Vpos with the MODE SELECT switch and use MODE ADJ switch ◁ and ▷.

Corresponding to the varied v-values, display on the LCD moves in vertical direction.

The vertical display time duration depends on the number of vertical display dots of the video signal being input.

The duration is $480 \times T_h$, $400 \times T_h$, $350 \times T_h$, and $200 \times T_h$, when the number of dots is 480 lines, 400 lines, 350 lines, and 200 lines, respectively.

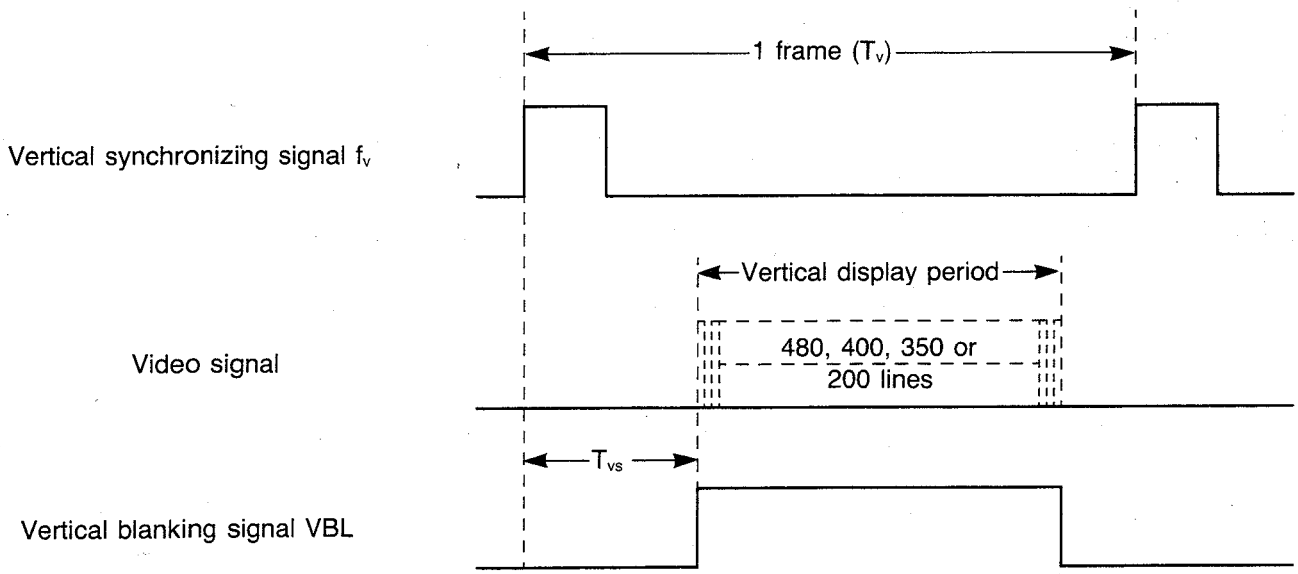


Fig. 6 VERTICAL BLANKING SIGNAL

6. CLOCK AND DATA PHASE COMPENSATION CIRCUIT

Generally, the computer produces video signals and synchronizing signals on the basis of a dot clock, and transmits them to color display. Therefore the dot clock f_{CK}, which is synchronized with the horizontal synchronizing signal, should also be synchronized with the video signal data. However, some of the phases are shifted due to difference of the output buffer delay of computer, difference of delay in the input circuit, and distortion of waveform in the signal cables.

To stabilize data from the video signals, the dot clock is delayed so that the relationship shown in Fig. 7 is obtained. Thus, the dot clock signal f_{CK} can sample the centers of the video signal data.

If sampling is made near the boundary between two data, the data value will become unstable. As a result, the LCD will provide flickering displays.

The circuit for the above described function consists of the PHASE CORRECTION 1 circuit and the register (CLK CORRECTION LATCH), as shown in Fig. 2 "BLOCK DIAGRAM."

Delay of the dot clock to video data is controlled by 4 bits out of 5 bits of the CLK CORRECTION LATCH, thus 16 levels of delay time can be made.

Delay time at each level is 2.5ns (TYP). The remaining 1 bit of the CLK CORRECTION LATCH is used for delaying HBL, according to the same reason. The control delays HBL by approximately 15ns (TYP).

A combination of these 5 bits provides 32 levels of phase compensation. For phase compensation control, IC2 (M.P.U.) inputs a control value into the register on IC1 (CLK CORRECTION LATCH).

The Phase value (0 to 31) may also be controlled by key entry, so that non-flickering images can be obtained by checking the display visually.

For the control procedure, select PHASE with the MODE SELECT switch and use MODE ADJ switch ◁ and ▷.

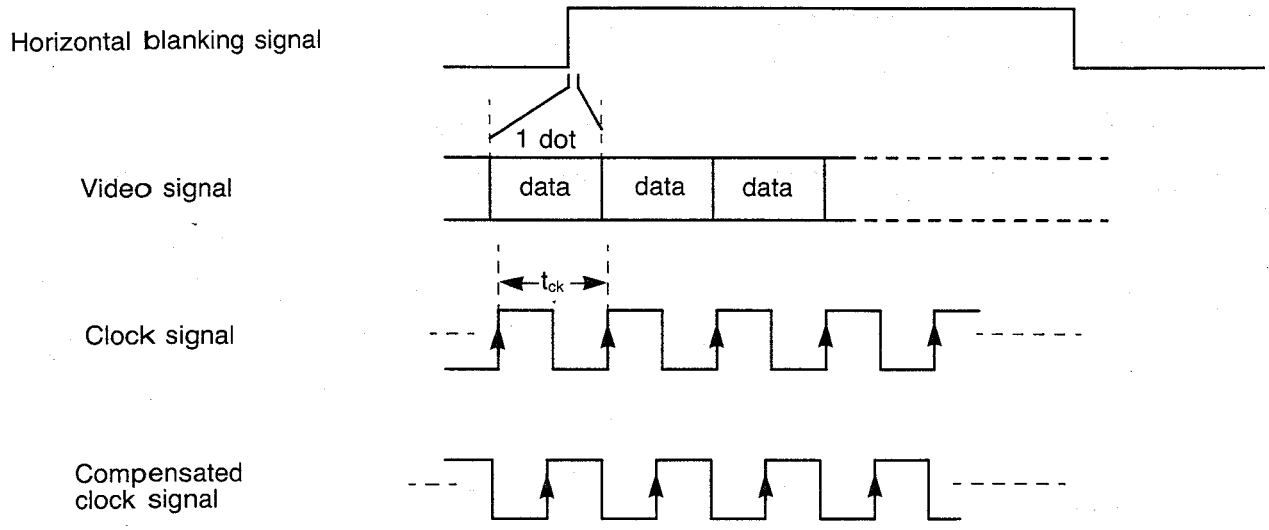


Fig. 7 CLOCK AND VIDEO SIGNAL COMPENSATION

7. WRITING FIELD MEMORY

As stated earlier, analog video signals are converted into 2-bit digital video signals (PR, PG, PB, SR, SG, and SB) by R, G, or B signal. In contrast to this, digital video signals are led to the input pins of the field memory (IC3, 4, 5, and 6) through the buffer circuit.

The writing operation in Fig. 2 "BLOCK DIAGRAM" is controlled by dot clock, SWCK, and signals UWE, URSTW, LWE, and LRSTW generated by the FIELD MEMORY WRITE SIGNAL GENERATOR based on HBL and VBL signals.

The video data of the upper half of the screen is written in IC3 and 4, and of the lower half, IC5 and 6.

8. LCD CONTROL CIRCUIT

To display video signals from the computer on an LCD UNIT, video signal data written in the field memory (IC3, 4, 5, and 6) must be read according to LCD driving timing, as stated previously.

In Fig. 2 "BLOCK DIAGRAM," a signal for driving the LCD UNIT is generated on the basis of CLK generated by the CLOCK GENERATOR.

Based on the CLK signal, the HBL GENERATOR CIRCUIT generates signals needed for horizontal synchronization. The VBL GENERATOR CIRCUIT generates signals needed for vertical synchronization, based on the HSYNC signal. The above signal timing is then generated from information S20, S35, and S40 concerning the type of computer received from IC2 (M.P.U.).

The AND BUFFER CIRCUIT carries out logical operation of horizontal synchronization signals generated by the HBL and VBL GENERATORs and generates control signals URE, URSTW, LRE, and LRSTW to read data from the field memory (IC3, 4, 5, and 6).

9. READING FIELD MEMORY

Reading the field memory is controlled by read clock SRCK signal generated by the HBL GENERATOR CIRCUIT and by URE, URSTW, LRE, LRSTW signals output from the AND BUFFER CIRCUIT. Video signals R2, R1, G2, G1, B2, and B1 are read from the field memory. The reading is performed asynchronously from the writing because frequency of video signals transmitted from the computer differs from that of video signals required by the LCD UNIT.

10. GENERATING LCD UNIT DRIVING VIDEO SIGNALS

The COLOR SIGNAL GENERATOR CIRCUIT internally carries out logical operation for signals R1, R2, G1, G2, B1, and B2 read from the field memory and generates the LCD UNIT driving video signals DR0-2, DG0-2, and DB0-2.
Here, it also receives from IC2 (M.P.U.) information (SELA, SELB, BROWN, and WHITE) concerning the computer and generates the LCD UNIT driving signals.

11. LCD UNIT

11.1. Interface signal

Table 6

Pin	Signal	Function	Note
1	CK	Clock signal for sampling each portion of data	
2	GND		
3	R0	RED Data Signal (LSB)	
4	R1	RED Data Signal	
5	R2	RED Data Signal (MSB)	
6	GND		
7	G0	GREEN Data Signal (LSB)	
8	G1	GREEN Data Signal	
9	G2	GREEN Data Signal (MSB)	
10	GND		
11	B0	BLUE Data Signal (LSB)	
12	B1	BLUE Data Signal	
13	B2	BLUE Data Signal (MSB)	
14	GND		
15	Hsync	Horizontal synchronizing signal (HS)	
16	GND		
17	Vsync	Horizontal synchronizing signal (VS)	
18	V_{CC}	+5V power supply (for Logic and LCD)	
19	GND		
20	V_{DD}	+12V power supply (for LCD)	
21	—	RESERVED	
22	—	RESERVED	

11.2. Circuit configuration

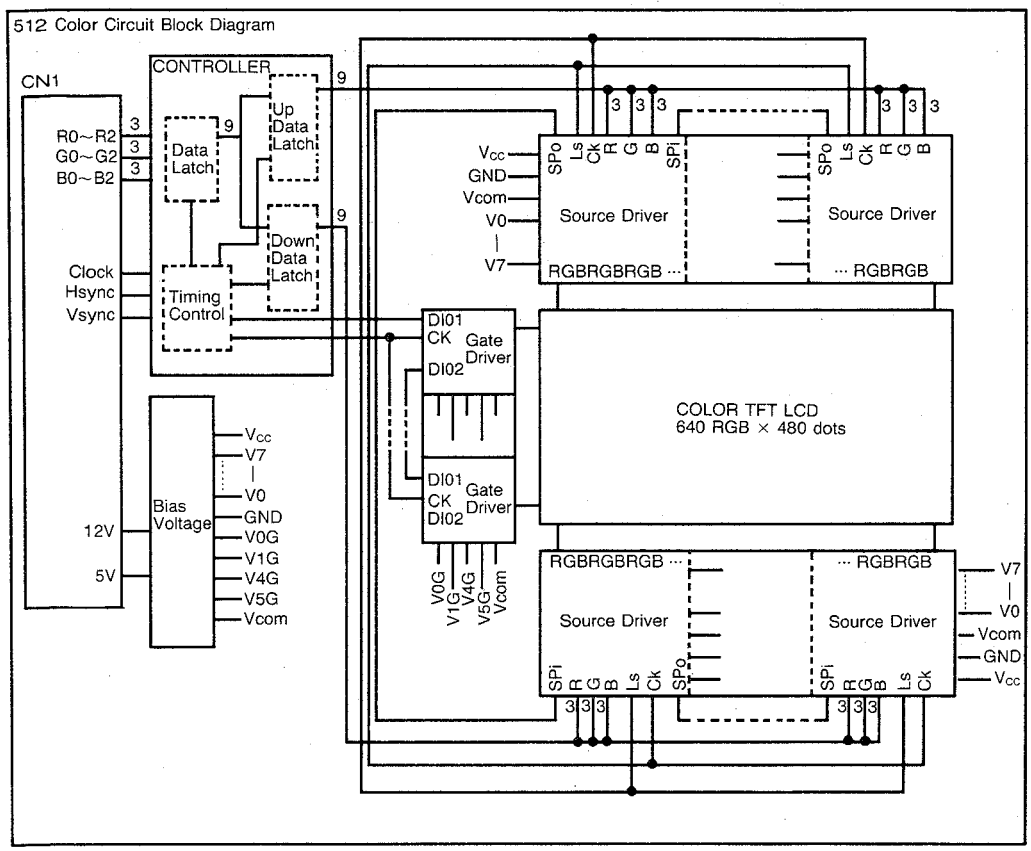


Fig. 8 LCD UNIT CIRCUIT BLOCK DIAGRAM

NOTES

1. The LCD units are assembled with special high accuracies. Do not disassemble them.
2. The deflector plates are easily scratched. Handle them with care.
3. Use absorbent cotton or soft cloth and carefully take off stain or dust on LCD panel surfaces. Use filtered compressed air to remove dust.
4. If waterdrops are left on the plates for a long time, the LCD panel may become discolored or become blotted. Dub with soft cotton and then use compressed air to blow off dust.
5. The LCD panels are made of glass. Dropping or hitting them against hard substances may cause breakdown or cracking of the panels. Treat them with care.
6. The CMOS LSIs used in the LCD units are sensitive to static electricity. Take necessary measures, such as grounding of workers, anti-static mats, grounding wrist-straps.

12. FUNCTIONS OF IC2 (MC68C11A8 M.P.U.)

IC2 is an HCMOS 8-bit single-chip microcomputer. It contains an 8-Kbyte ROM, 512-byte EEPROM, 256-byte RAM, and hardware functions including timer system and real time interrupt circuit and software functions including the instruction of strengthening M6800/M680/system. In the QA-1000, IC2 is used to provide the following control functions.

12.1. Controlling of IC1 (LCDC)

IC2 sets the following display timing parameters into the registers on IC1.

Frequency

H-position

V-position

H-polarity

Video type

Phase

Addressing to the registers on IC1 and data inputting are executed according to the timing shown in Fig. 9.

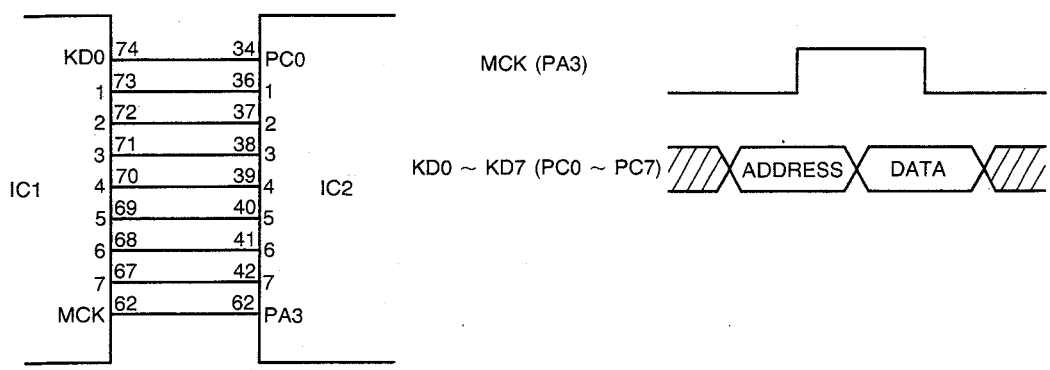


Fig. 9

Gate Array Register (1)

Table 7

Address	Bit	Signal	Description	Remark
01	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			
02	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			
03	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			
04	7			
	6		MDA VGA·EGA Other	
	5	VGA·EGA	Video process VGA/EGA mode 0 1 0	
	4	MDA	Video process MDA mode 0 1 1	
	3	S 48	Video band 480 lines	
	2	S 40	Video band 400 lines	
	1	S 35	Video band 350 lines	
	0	S 20	Video band 200 lines	

Gate Array Register (2)

Table 8

Address	Bit	Signal	Description	Remark
05	7	DSL 7	Dot clock phase adjustment	
	6	DSL 6		
	5	DSL 5		
	4	DSL 4		
	3	DSL 3		
	2	DSL 2		
	1	DSL 1		
	0	DSL 0		
06	7			
	6			
	5			
	4			
	3			
	2	FR 10		
	1	FR 9	Dot clock divider ratio	
	0	FR 8		
07	7	FR 7	Dot clock divider ratio	
	6	FR 6		
	5	FR 5		
	4	FR 4		
	3	FR 3		
	2	FR 2		
	1	FR 1		
	0	FR 0		
08	7			
	6			
	5			
	4			
	3			
	2			
	1	HL 9	Horizontal front porch value (H POS)	
	0	HL 8		

Gate Array Register (3)

Table 9

Address	Bit	Signal	Description	Remark
09	7	HL 7	Horizontal front porch value (H POS)	
	6	HL 6		
	5	HL 5		
	4	HL 4		
	3	HL 3		
	2	HL 2		
	1	HL 1		
	0	HL 0		
0A	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0	VL 8	Vertical front porch value (V POS)	
0B	7	VL 7	Vertical front porch value (V POS)	
	6	VL 6		
	5	VL 5		
	4	VL 4		
	3	VL 3		
	2	VL 2		
	1	VL 1		
	0	VL 0		
0C	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			

Gate Array Register (4)

Table 10

Address	Bit	Signal	Description	Remark
0D	7			
	6	HRV	Horizontal synchronizing signal polarity select	0/1 −/+
	5			
	4			
	3			
	2			
	1			
	0			
0E	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			
0F	7			
	6			
	5			
	4			
	3			
	2			
	1			
	0			

12.2. Key data and their functions

Key entry signals "◁" "▷" "MODE SELECT" and "RESET" are inputted to pin 13 (PE0), pin 15 (PE1), pin 17 (PE2), and pin 19 (PE3) on IC2.

With the key untouched, IC2's input pin stated above is set to the "H" level. When the key is pressed, it is set to the "L" level.

⟨Functions⟩	⟨IC2⟩
"▷"	pin 13 (PE0)
"◁"	pin 15 (PE1)
"MODE SELECT"	pin 17 (PE2)
"RESET"	pin 19 (PE3)

1. MODE SELECT key (without repeat function)

   Adjustment mode selector key. Each time this key is pressed, the mode changes as follows:

   Phase → H-pos → V-pos → Freq →

2. ▷ key (with repeat function)

   Increments the setting value step by step for the adjusting parameter selected with the MODE SELECT key.

   Phase mode: 0 → 1 → 2 → · · · · · → 31 → 0

   H-pos mode: The value varies and the screen image may move to the right.

   V-pos mode: The value varies and the screen image may move up.

   Freq mode: The value varies and the frequency may become higher.

3. ◁ key (with repeat function)

   Decrements the setting value step by step for the adjusting parameter selected with the MODE SELECT key.

   (Functions opposite to the ▷ key.)

   Phase mode: 0 → 31 → 30 → · · · · · → 1 → 0

   H-pos mode: The value varies and the screen image may move to the left.

   V-pos mode: The value varies and the screen image may move down.

   Freq mode: The value varies and the frequency may become lower.

4. RESET key

   Sets each register in IC1 with the initial value for the computer connected.

5. ALL RESET key entry

   With the RESET key pressed, press the MODE SELECT and ◁ keys concurrently, then all settings of video signal are reset to the unit's own initial values.

12.3. Status indication by mode select indicators

The unit has four LEDs for mode select indicators. The operator will know the status of the unit from lighting or flickering condition of these LEDs.

The mode select indicator LEDs show each mode "Phase," "H-pos," "V-pos," or "Freq" and are controlled via IC8 with IC2's pin 8 (PB4), pin 7 (PB5), pin 6 (PB6), and pin 5 (PB7), respectively.

When IC2's input pin stated above is set to the "H" level, the corresponding LED is lit. When it is set to the "L" level, the LED is turned off.

〈Mode select indicators〉 〈IC2〉

Phase ..... pin 8 (PB4)

H-pos ..... pin 7 (PB5)

V-pos ..... pin 6 (PB6)

Freq ..... pin 5 (PB7)

Table 11 shows the status of the unit and the mode select indicator LEDs' lighting or flickering condition.

Table 11

Mode select indicator				Status of the unit		
PHASE	H-POS	V-POS	FREQ		◁/▷ keys	Mode select key
○	○	○	○	No signal (all off)	Ineffective	Ineffective
●	○	○	○	Phase adjusting mode	Effective	Effective
○	●	○	○	Horizontal position adjusting mode	Effective	Effective
○	★	○	○	Horizontal position adjusting mode (repeated)	Used	Ineffective
○	○	●	○	Vertical phase adjusting mode	Effective	Effective
○	○	★	○	Vertical phase adjusting mode (repeated)	Used	Ineffective
○	○	○	●	Frequency adjusting mode	Effective	Effective
○	○	○	★	Frequency adjusting mode (repeated)	Used	Ineffective
●	●	●	●	ALL RESET functioning	Ineffective	Ineffective

○: Off ●: On ★: Flickering

✻ Key repeat function is not available in the phase adjusting mode.

12.4. RESET circuit

IC7 (TL7705CPS-B) detects the power voltage, V_{CPU}, for IC2 and its peripheral parts, and generates $\overline{RESET}$ signal.

If the voltage of V_{CPU} decreases below the detection voltage V_{S1} (TYP 4.5V) when the power is turned off, IC7 shifts the $\overline{RESET}$ signal level to "L."

If the voltage of V_{CPU} increases and exceeds the detection voltage V_{S1} plus hysteresis width V_{HYS1} (TYP 15mV), IC7 starts charging the timing capacitor C70 with a constant current. After the pulse width of t_{po} ($= 1.3 \times C_t \times 10^4$(s)), IC7 shifts the $\overline{RESET}$ signal level to "H." (Fig. 10)

IC9 (S-8054 ALB) detects the power voltage V_c to generate power-OFF detection signal. If the voltage of V_c decreases below the detection voltage V_{S2} (TYP 4.15V) when the power is turned off, IC9 shifts the power-OFF detection signal level to "L." When the detection voltage of V_c increases and exceeds the detection voltage V_{S2} plus hysteresis width V_{HYS2} (TYP 200mV) when the power is turned on, IC9 shifts the power-OFF detection signal level to "H." (Fig. 11)

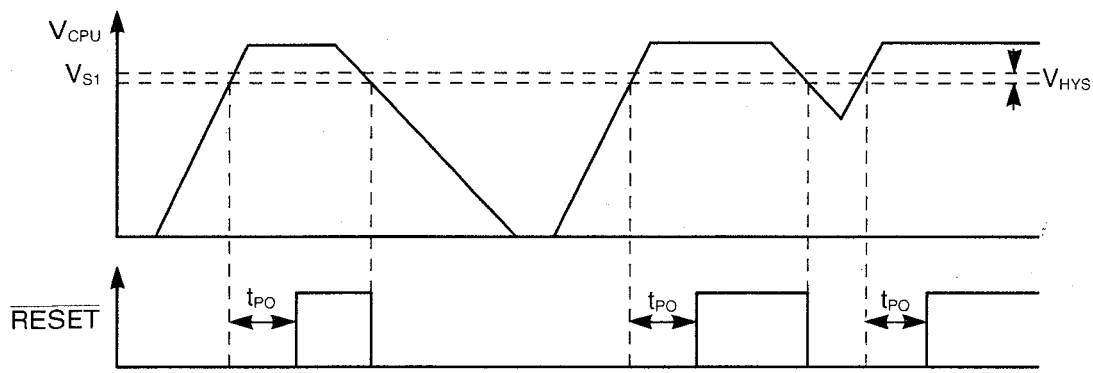


Fig. 10

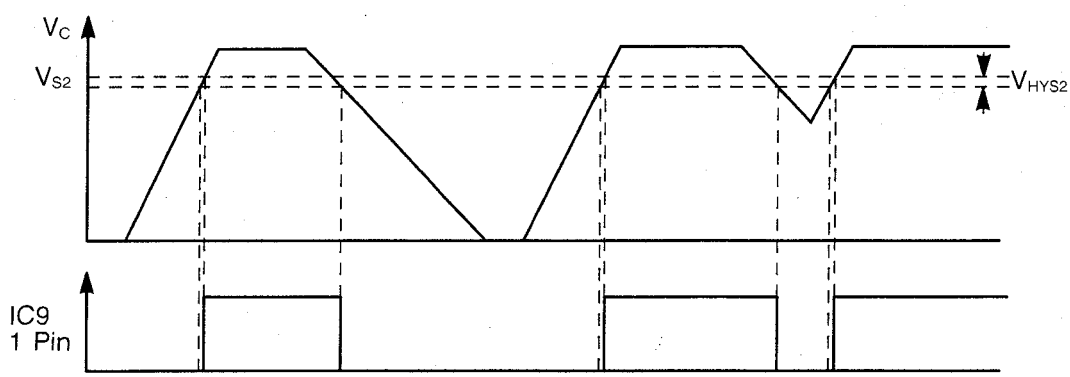


Fig. 11

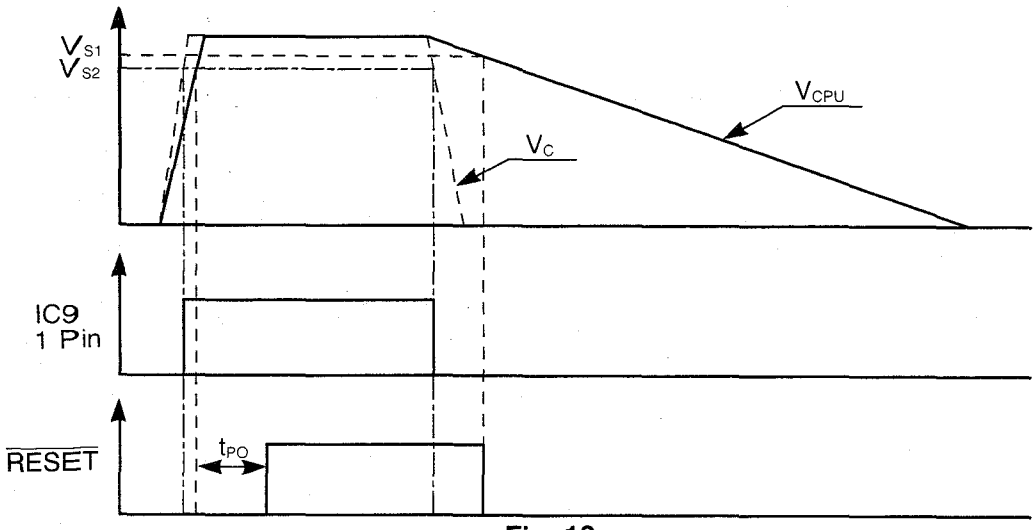


Fig. 12

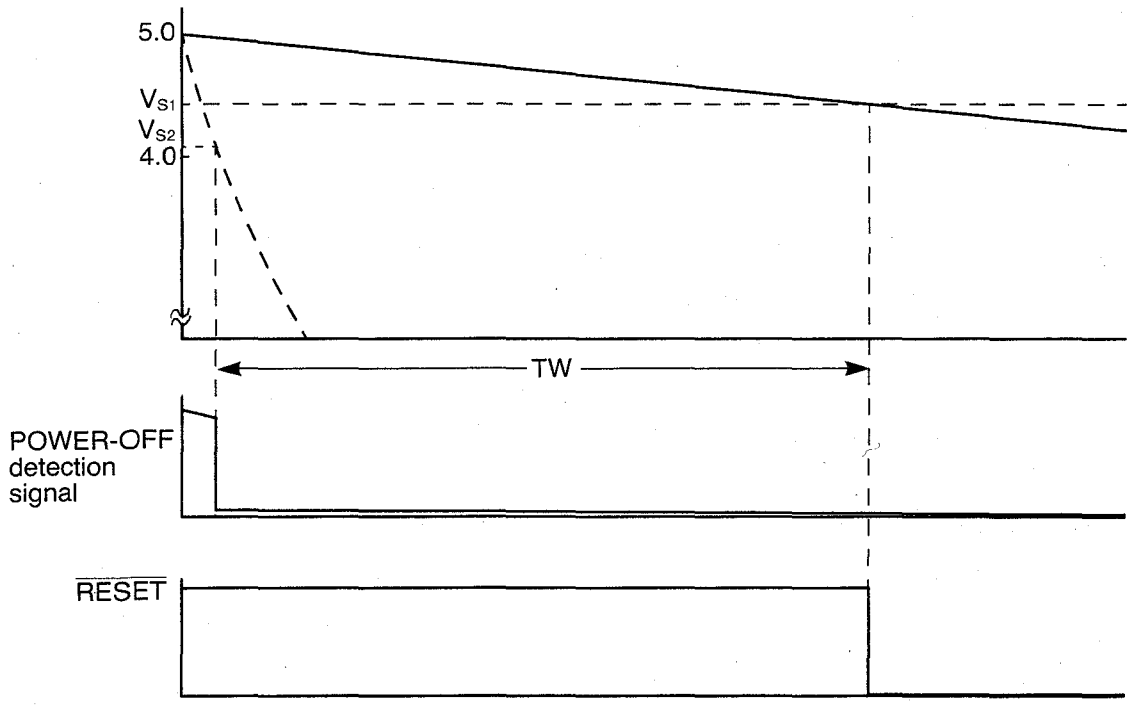


Fig. 13

12.5. Operation of V_c and V_{cpu} and IC2 (M.P.U.)

V_c and V_{cpu} increase with the power being turned on. If V_{cpu} exceeds V_{S1} + V_{HYS1}, the $\overline{\text{RESET}}$ signal is shifted to "H" level with the timing given in Fig. 10. IC2's reset operation is canceled. The program is executed.

If V_c decreases sharply below V_{S2} when the power is turned off, the power OFF detection signal is shifted to "L." On the other hand, V_{cpu} is backed up by C69 (27mF) capacitor so that it can maintain 4.5V for the time duration of t_w after the trailing edge of the power OFF detection signal. See Fig. 13 (t_w is the time to input the data into EEPROM on IC2.) If V_{cpu} decreases below V_{S1}, the $\overline{\text{RESET}}$ signal level is shifted to "L." Then IC2 starts reset operation.

12.6. Video signal input automatic identification

This function analyzes the video signal from the computer connected to the QA-1000, and automatically adjusts input timing in IC2 (MPU).

Automatic identification signals are input from IC1 to IC2.

(1) VSC (IC1, pin 59 → IC2, pin 64)

It is the vertical synchronizing signal of the video signal from the connected computer. IC2 measures the period of this signal.

(2) 256HC (IC1, pin 60 → IC2, pin 63)

It is the horizontal synchronizing signal of the video signal from the connected computer, divided by 256. IC2 measures the period of this signal.

(3) HPOL (IC1, pin 66 → IC2, pin 52)

It indicates the polarity of the horizontal synchronizing signal of the video signal from the connected computer.

IC2 identifies the type of computer from above information (1) PA1 through (3) PA3 according to the identification, IC2 writes the parameters into the registers on IC1 for automatic setting.

Identifying of NO CONNECTION:

If 256HC signal remains unchanged for a certain period (approximately 130ms), IC2 identifies NO CONNECTION. Turns both VCOH and VCOL to "L" level to stop VCO function, and turns WHITE signal to "H" to display white.

The white signal change high level and the LCD displays white screen.

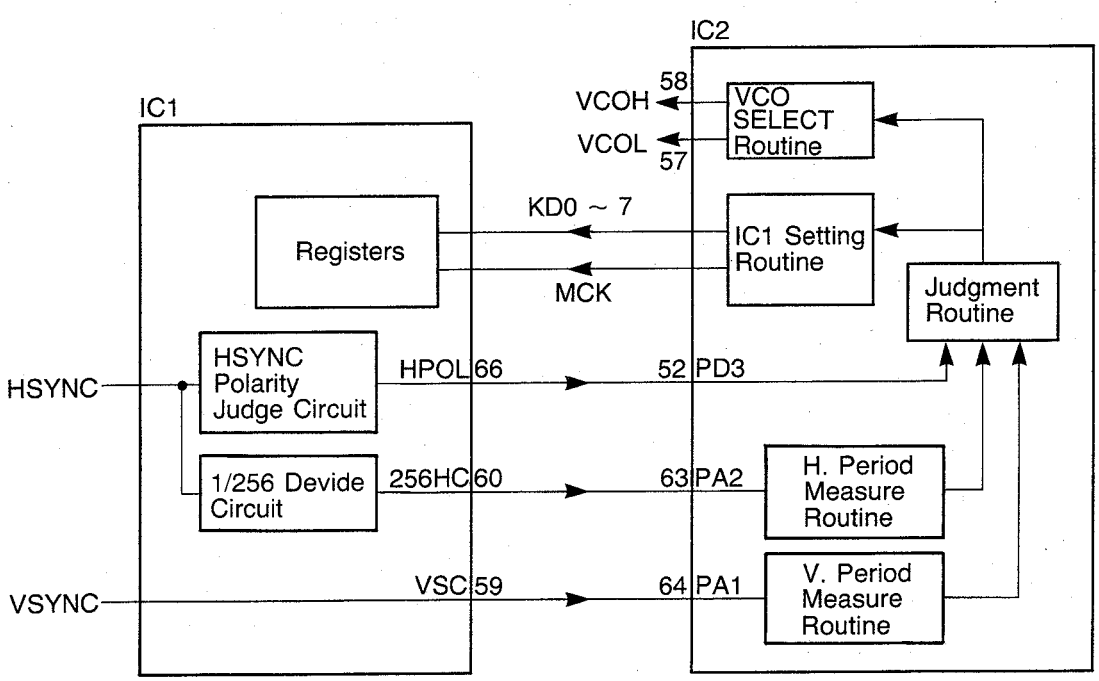


Fig. 14

12.7. EEPROM control function

IC2 has the EEPROM for writing 4 parameters started in 12.2 of all computers that can be connected to QA-1000.

The timing setting value is written into the EEPROM under the following four conditions:

1. ALL RESET functioning
2. RESET functioning
3. Turning the power off
4. Changing the computer connected

Writing into the EEPROM when turning the power off, however, is carried out only when the setting value is altered by key entry.

13. POWER SUPPLY

The AC adaptor that comes with the QA-1000 supplies a regulated power voltage V_{IN} (12VDC) to the QA-1000. From V_{IN}, 5V power (V_{cpu} and V_c), −5V power, LCD driving 12V power (V_{DD}), and PLL power (V_{VCO}) are made.

13.1. DC-DC converter for +5V (V_{cpu} and V_c)

IC32 in Fig. 15 is a controller for a fixed frequency pulse width modulation (PWM) switching regulator. It contains two controller circuits for different constant voltages.

One of these controllers is used to create 5V power supply from the input power supply V_{IN} (12VDC). (The other controller is used for −5V.)

IC32 contains a saw-tooth wave oscillator whose oscillating frequency is determined by capacitor C101 connected to pin 1 and resistor R125 connected to pin 2. In this circuit configuration, a saw-tooth wave of approximately 75kHz is observed at pin 1 of IC32. Basically this saw-tooth wave is compared to a control signal (observed at pin 5 of IC32). While the saw-tooth wave voltage is smaller than the control signal voltage, the output transistor on IC32 is conductive. The output pulse (indicating the conductive state) is output from pin 7 of IC32 and supplied to the base of the external transistor Q6 through the buffer circuit of transistor Q12. The output voltage is fed back to pin 3 of IC32 through R126, R124, and VR2. A reference voltage of 2.5V is output from pin 16 of IC32. On IC32, the half voltage of the reference voltage and the feedback signal supplied to pin 3 of IC32 make the control signal. As described above, output voltage is stabilized by the pulse width from pin 7 which is generated by comparing the control signal with the saw-tooth wave.

The +5V power supply output voltage is adjusted by VR2 so that voltage V_{cpu} at point TP1 becomes 5.1V. Voltage V_c at point TP2 approximately 5V, which is slightly lower than V_{cpu}. This is because the load on the board for V_c is greater than the load for V_{cpu}, so that the forward voltage for diodes D4, D5, and D6 is higher than that for D3.

The voltage supplied to pin 6 of IC32 is called a dead time control signal. It controls the maximum ON period of the output transistor on IC32.

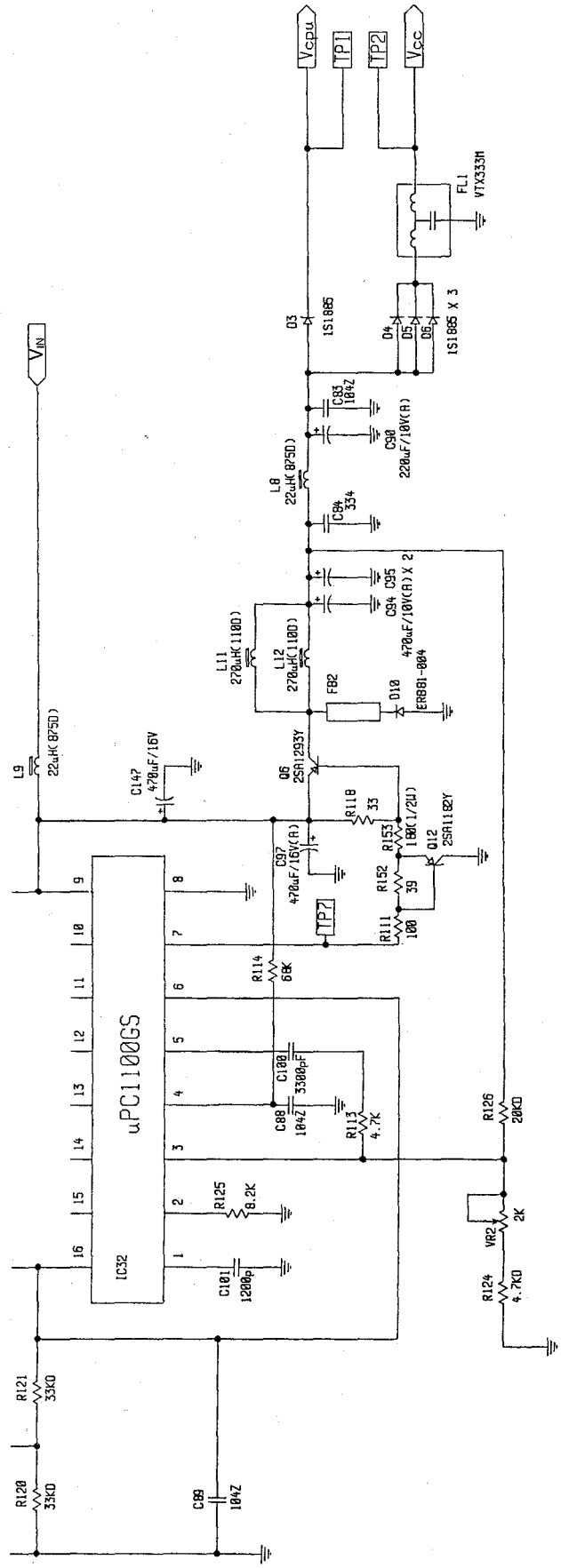


Fig. 15 DC-DC CONVERTER FOR +5V (V_{cpu} and V_c)

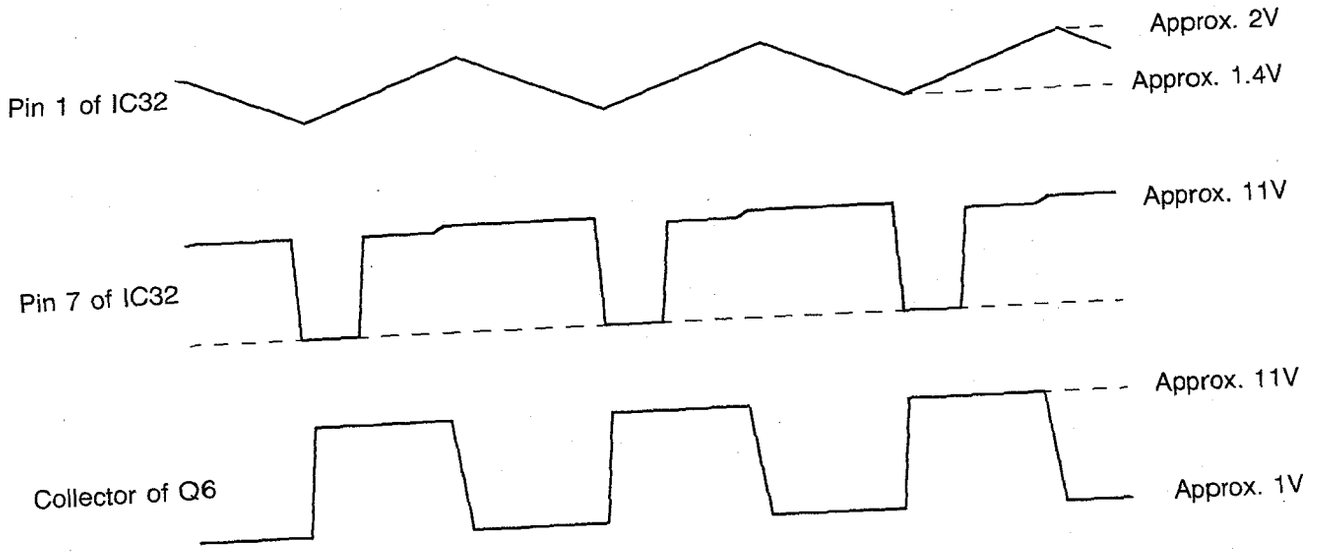


Fig. 16

13.2. DC-DC converter for −5V

One of the constant voltage controllers in the switching regulator controller (IC32) in Fig. 17 is used to configure a DC-DC converter that converts the input power supply V_{IN} (12VDC) to −5V. (The other controller is used for the +5V power supply.)

The same saw-tooth wave oscillator on IC32 for the +5V control is also used for −5V. The basic circuit operation is similar to the DC-DC convertor for +5V.

The output voltage is fed back to pin 13 of IC32. The half voltage of the reference voltage input from pin 14 of IC32 and the feedback signal make a control signal. The control output pulse is output from pin 10 of IC32 and supplied to the base of the external transistor Q5.

−5V should be observed at point TP3 without any adjustment.

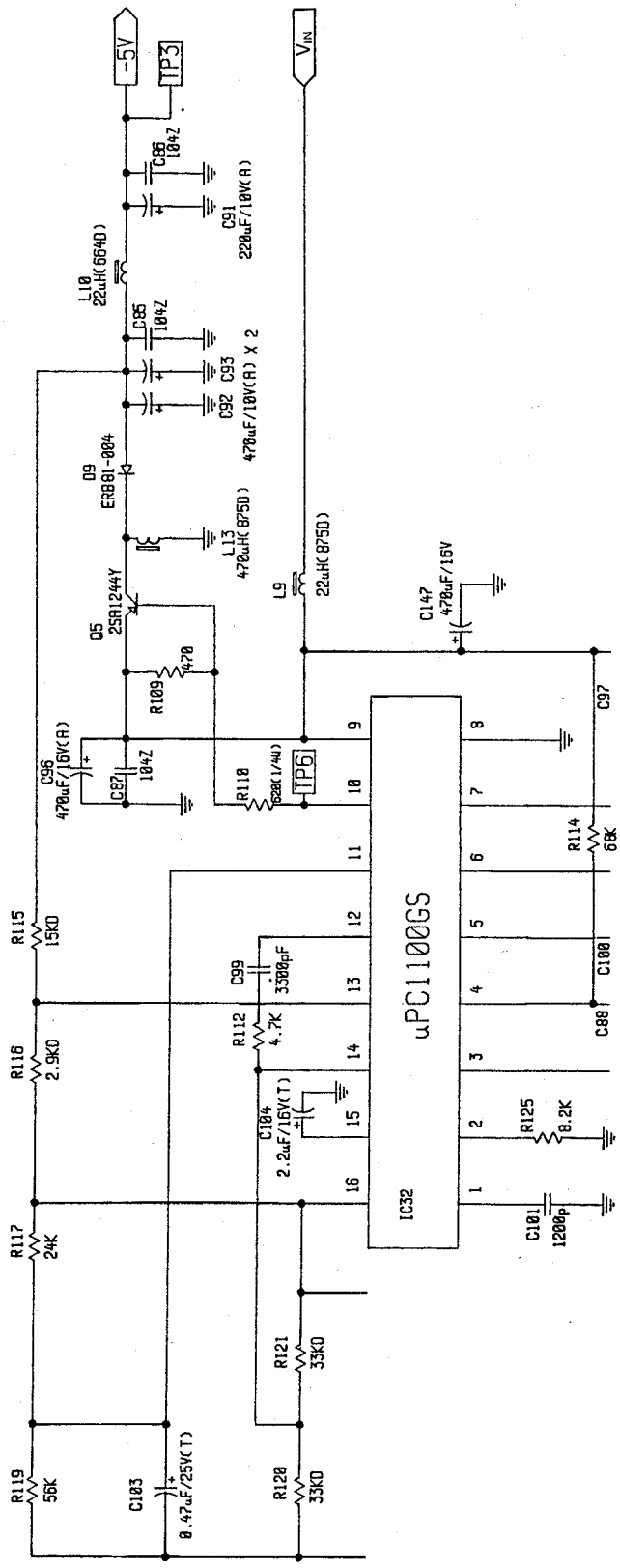


Fig. 17 DC-DC CONVERTER FOR −5V

13.3. DC-DC converter for V_{DD} (LCD driving)

Fig. 19 shows the DC-DC converter for generating LCD driving power supply (V_{DD}).

IC50 is a switching regulator controller that is of fixed oscillating frequency PWM control type. With the internal voltage regulating circuit, it generates a reference voltage and outputs it through pin 8. The oscillating frequency of the internal saw-tooth wave oscillator is determined by capacitor C138 and resistor R140. It is approx. 100kHz and can be observed at pin 7.

In addition, the uppermost and lowermost values are approx. 0.65V and 0.2V, respectively.

The power source output voltage of +12V is divided by resistors R137, VR3, and R139 and enters pin 1. With internal ERROR-AMP, the voltage applied to pin 1 is compared with the internal reference voltage, amplified, and output through pin 2.

The polarity of the voltage output here is inverted. For example, if the input voltage at pin 1 is higher than the internal reference voltage, voltage output from pin 2 decreases. If the input voltage at pin 1 is lower than the internal reference voltage to the contrary, voltage output from pin 2 increases. C137 and R138 connected between pins 1 and 2 make up the impedance that sets gain of the ERROR-AMP.

The output voltage of the ERROR-AMP (voltage at pin 2) is compared with the saw-tooth wave of pin 7. If the latter is lower than the former, a high level signal is output from pin 4, letting the emitter voltage of transistor Q11 be at the high level and transistor Q9 be turned on.

Meanwhile, diodes D11, D12, and D13 reduce the input voltage of 12V from the AC adaptor to approx. 10V.

When transistor Q9 is turned on, a current from diodes D11, D12, and D13 flows through choke coil L14 and transistor Q9; and choke coil L14 collects electromagnetic energy.

If the voltage of the saw-tooth wave is higher than the voltage at pin 2, the output voltage at pin 4 becomes low level. (Turning Q9 off)

When transistor Q9 is turned off, the electromagnetic energy collected in choke coil L14 is discharged through diode D14 and charges capacitors C143 and C144.

Transistor Q8 is employed to supply the 12V output according to the timing required by the LCD. The detailed operation of transistor Q8 will be described later.

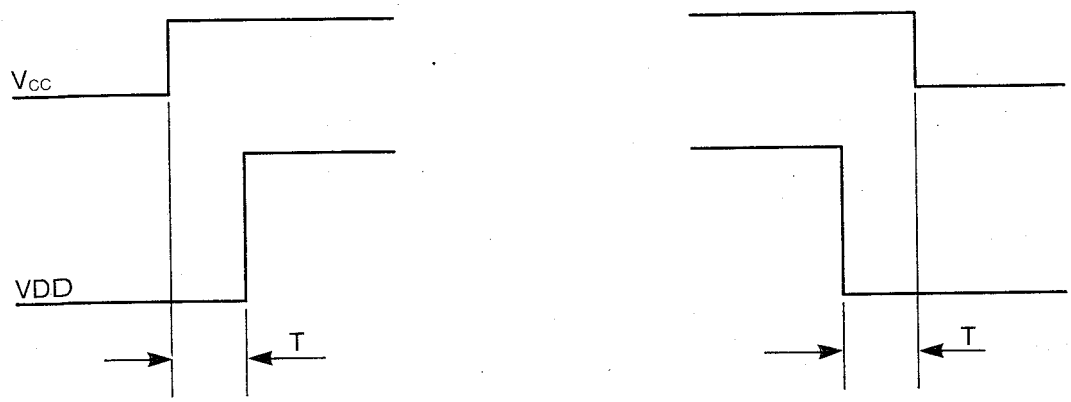
If voltage at pin 1 drops abnormally due to some factors, for example, short-circuited 12V output, IC50's pin 6 lets C139 be charged with a constant current (approx. 30μA). When the charged voltage of capacitor C139 reach approx. 1.5V, signal output from pin 4 stops, and switching function of transistor Q9 also stops.

- Control sequence circuit for 12V output

Sequence of the voltage supplied to the LCD UNIT when turning on/off SW of QA-1000 is shown in Fig. 18.

As stated before, the unit is provided with a circuit that prevents straight through application of the

output voltage from the AC adaptor to the V_{DD} terminal of the LCD UNIT, which may occur when IC1 stops the switching function due to some factors, for example, short-circuited 12V (V_{DD}) output.



Ta ≧ 0 SW-ON

Fig. 18

Tb ≧ 0 SW-OFF

ICs 48 and 49 are of open collector output type and monitor the source voltage supplied to the LCD UNIT and V_{CC}. These ICs are connected each other by output pin 3 on both ICs and are pulled up by resistor R156. Capacitor C150 and resistor R159 are provided to monitor whether the 12V switching power supply is operating. While transistor Q9 is correctly repeating on/off function (switching function), capacitor C150 attempts to be charged by V_{CC} via R159, but the electric charge is drawn by diode D16, and voltage at the positive pin of capacitor C150 constantly remains at approx. 0V because the collector voltage of transistor Q9 drops to 0V each time switching occurs. In contrast, when transistor Q9's switching is not functioning, the collector voltage of transistor Q9 remains constant, so capacitor C150 is charged by V_{CC} via R159, and the voltage at positive pin of capacitor C150 is at approx. 5V.

When, with SW of the QA-1000 being turned on, the source voltage inputted to the LCD UNIT increases to beyond approx. 10V, and V_{CC} becomes higher than approx. 4.5V, voltage at pin 3 of both IC48 and 49 is set to the high level (4.5V or higher).

Assuming here that the switching function of transistor Q9 is correctly operating, the voltage at positive pin of capacitor C150 is 0V as stated earlier. So, transistor Q13 is turned off, and Q7 and Q8 are turned on, and the output of the 12V switching power source is supplied to the V_{DD} terminal of the LCD UNIT.

If SW1 is turned off while the QA-1000 is in normal operation, the source voltage inputted to the LCD UNIT starts to drop. Because IC48's pin 3 is set to the low level when the source voltage becomes under approx. 10V, transistors Q7 and Q8 are turned off, cutting the output of 12V switching power supply.

The 5V DC-DC converter here still outputs 5V correctly. It starts to drop when the source voltage inputted to the LCD UNIT further drops.

In addition, if the switching function of transistor Q9 is stopped, voltage of positive pin on capacitor C150 is set to the high level. So, transistor Q13 is turned on, and Q7 and Q8 are turned off, and the output terminals of the 12V DC-DC converter are disconnected from the V_{DD} terminal of the LCD UNIT.

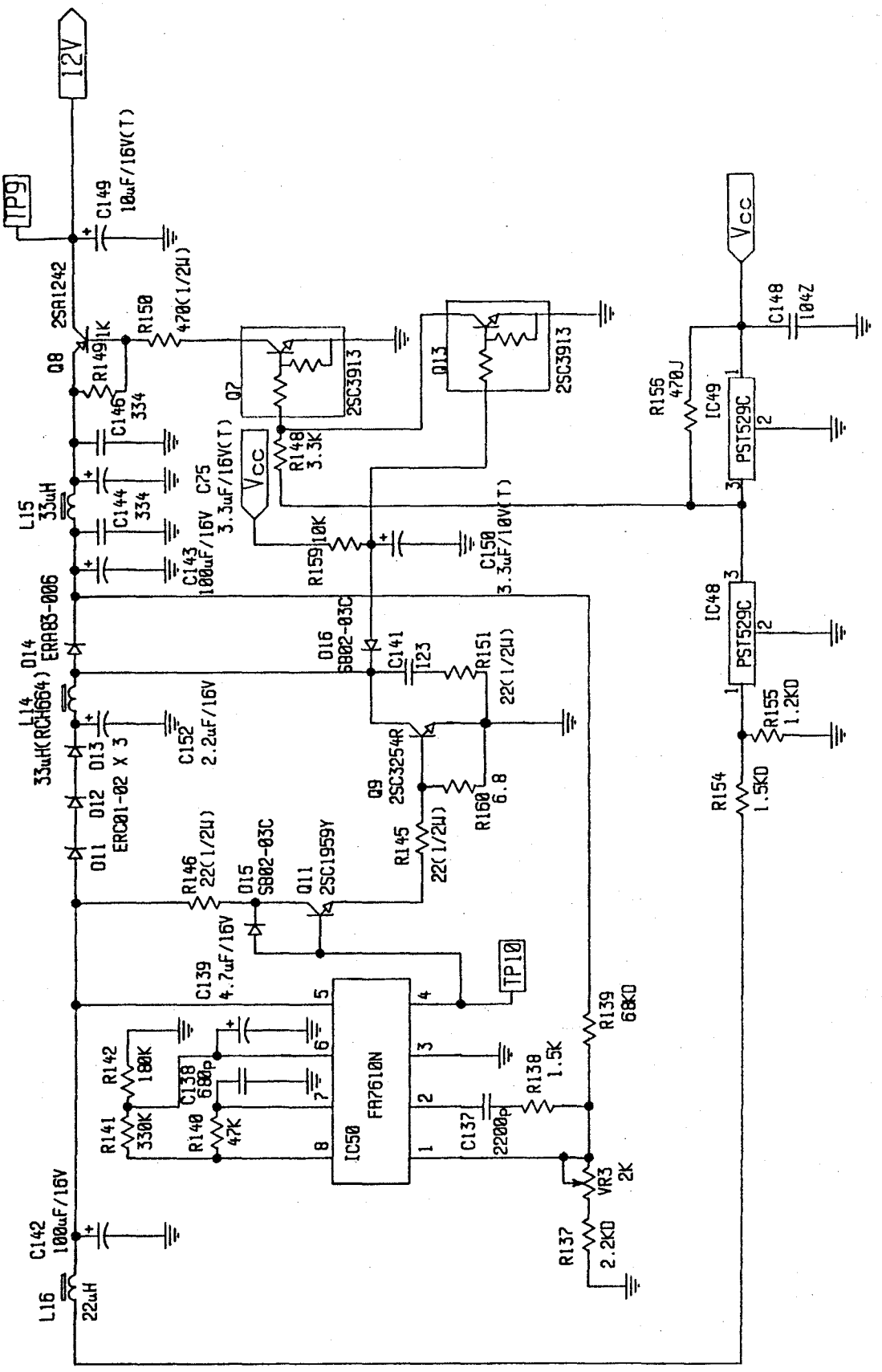


Fig. 19 DC-DC CONVERTER FOR V_{DD} (LCD DRIVING)

13.4. Power supply for PLL

Fig. 20 shows the power supply for the PLL, V_{VCO}. V_{VCO} of +10V is generated by a series regulator (IC47) from the input power supply V_{IN} (12VDC).

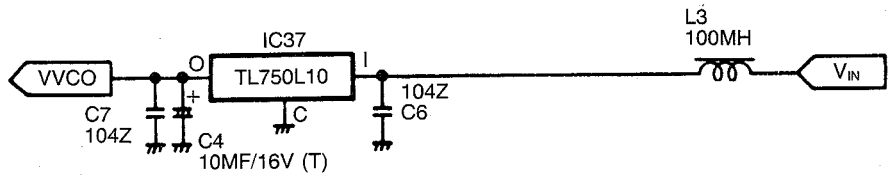


Fig. 20

13.5. Power supply for V_{FAN}

Fig. 21 shows the power supply for the fan motor, V_{FAN}. V_{FAN} is directly obtained from the input power supply V_{IN} (12VDC) through L2.

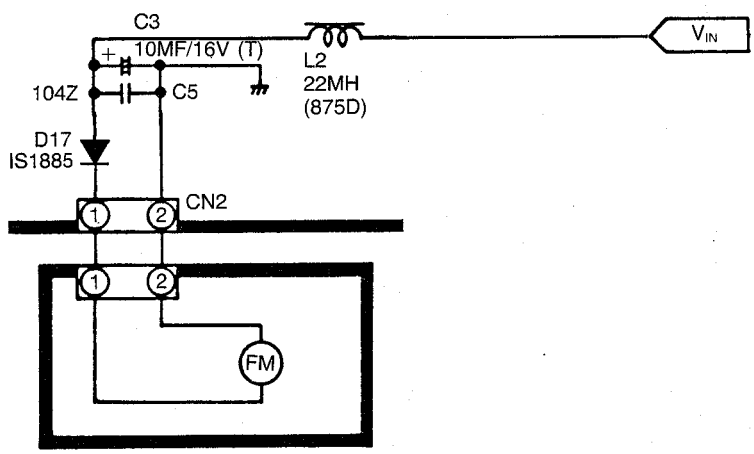
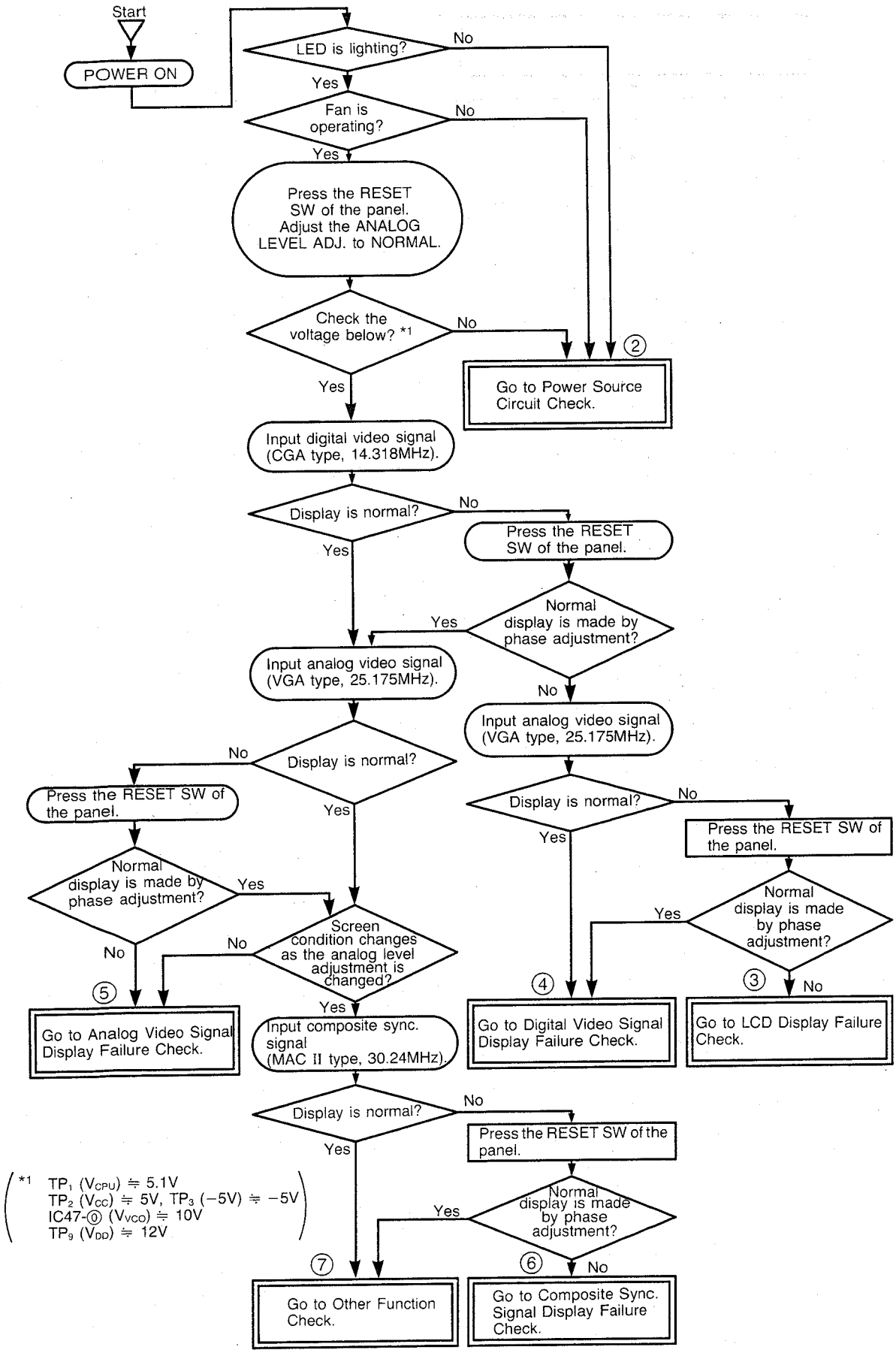
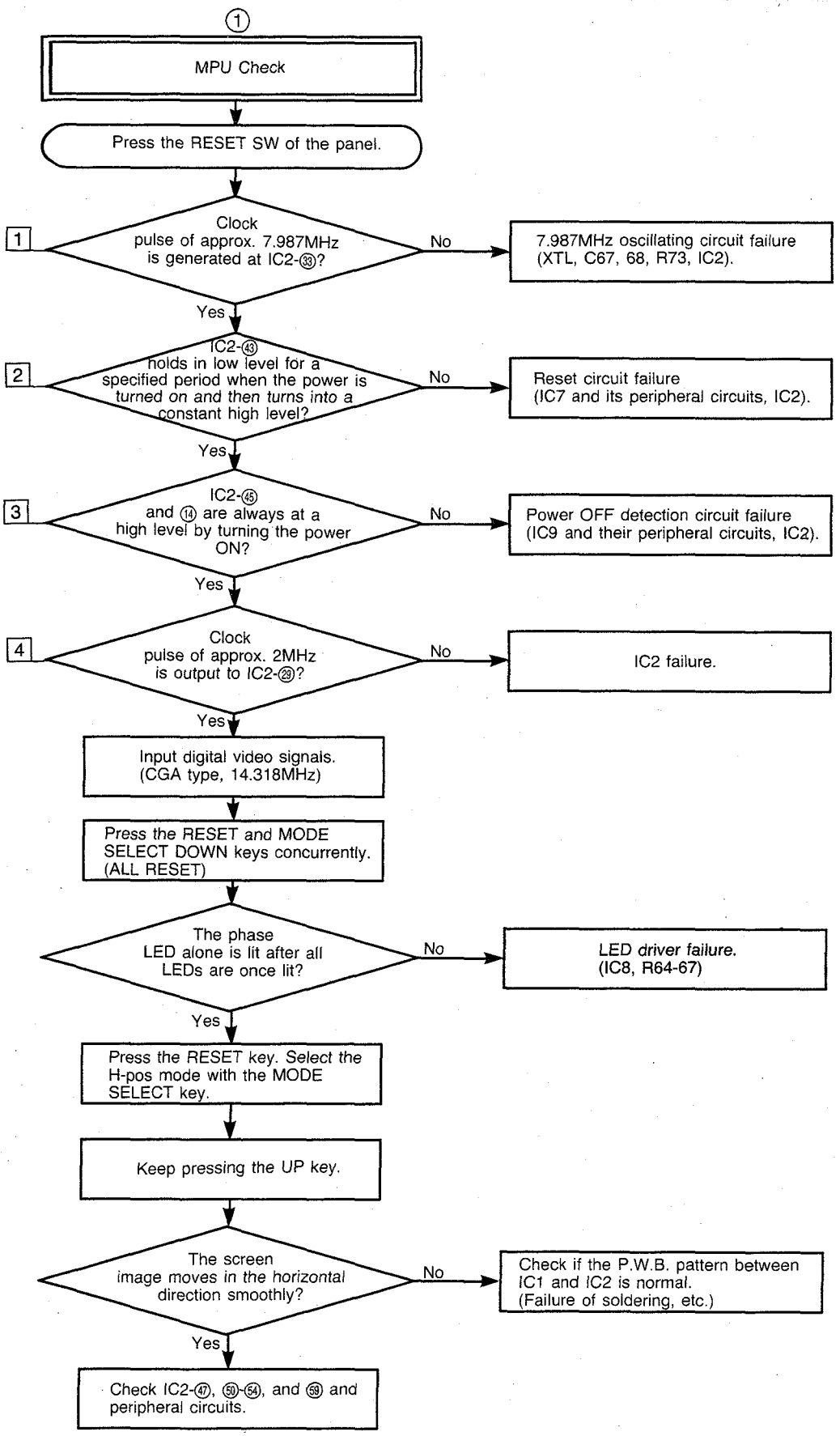
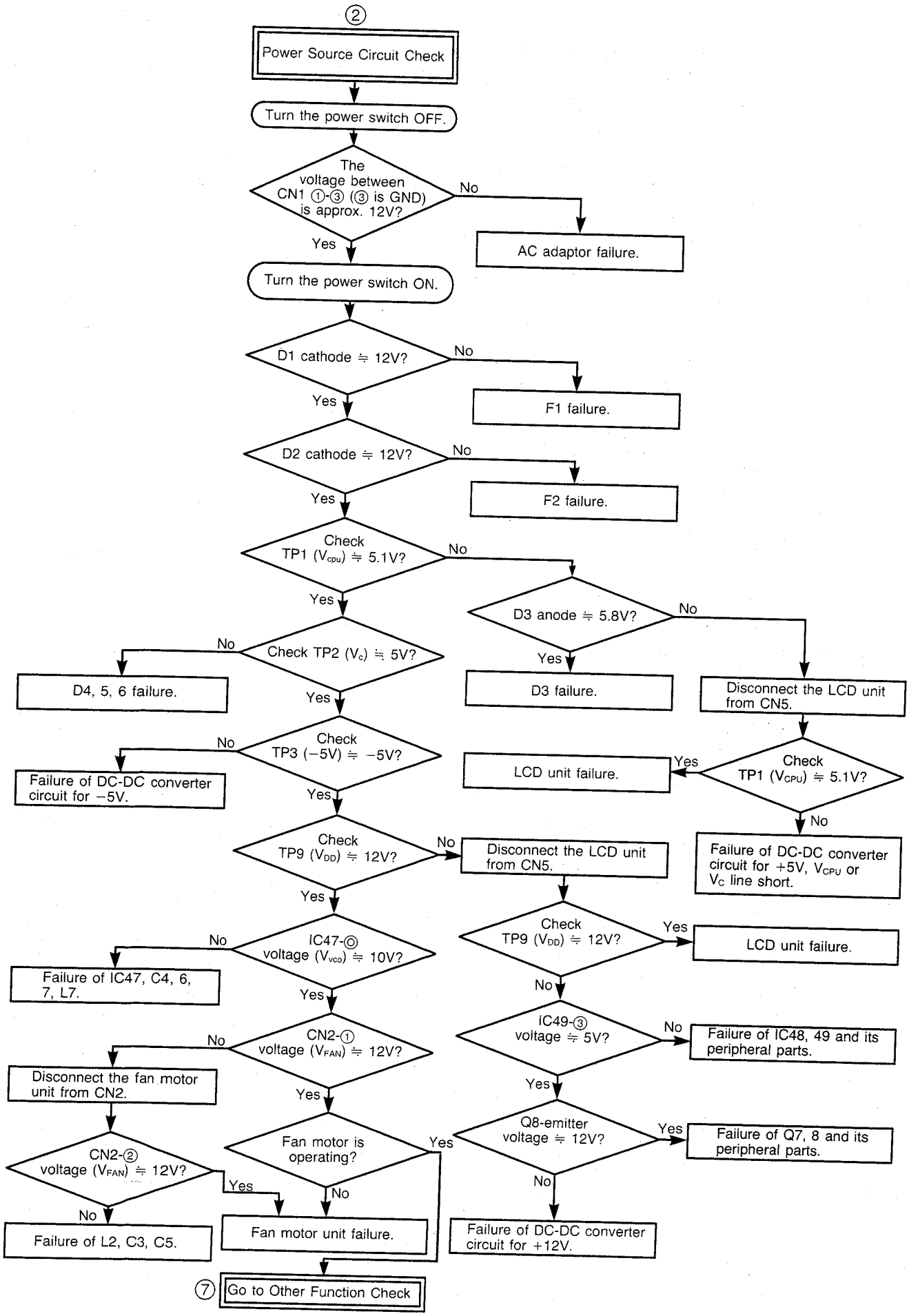


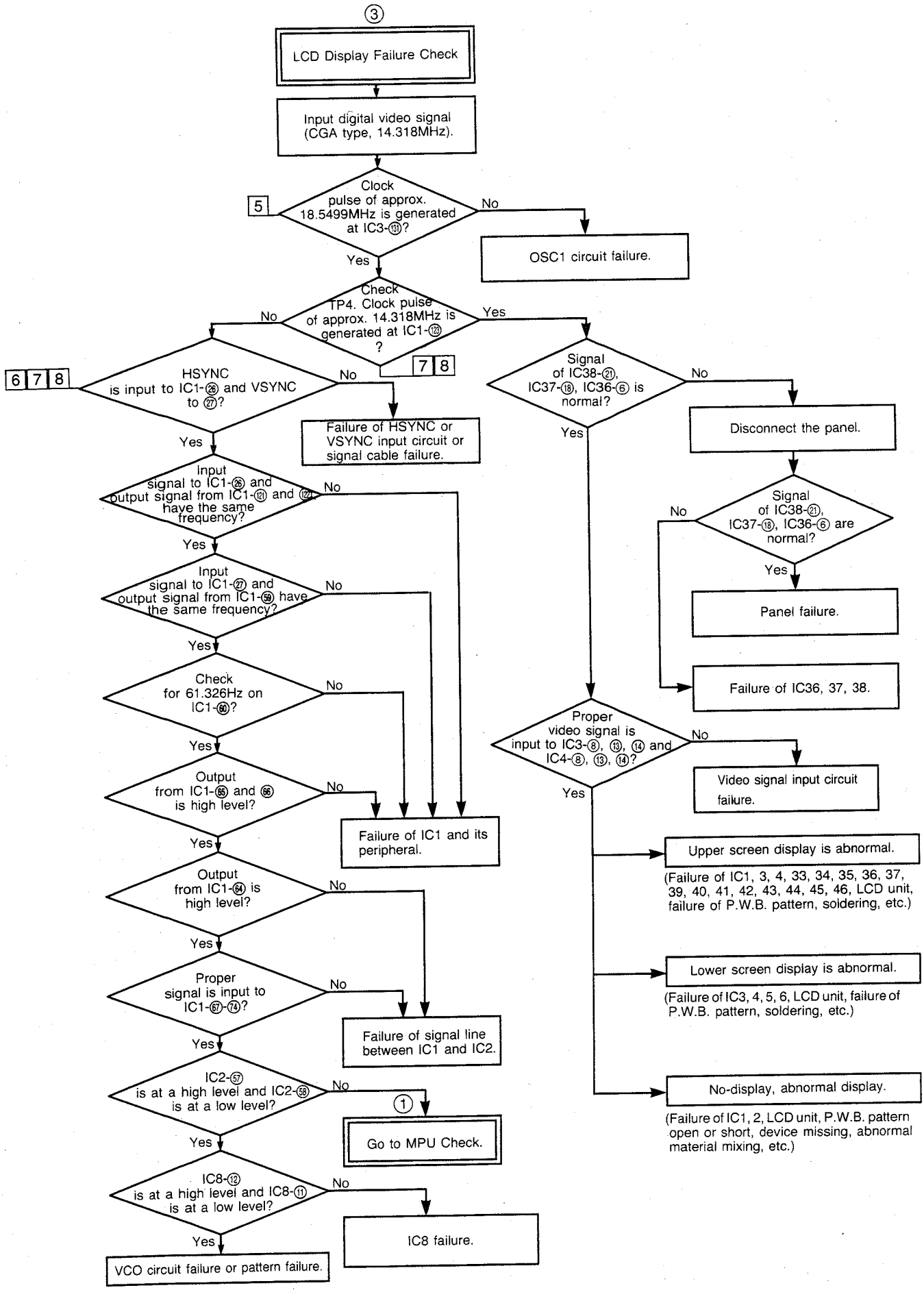
Fig. 21

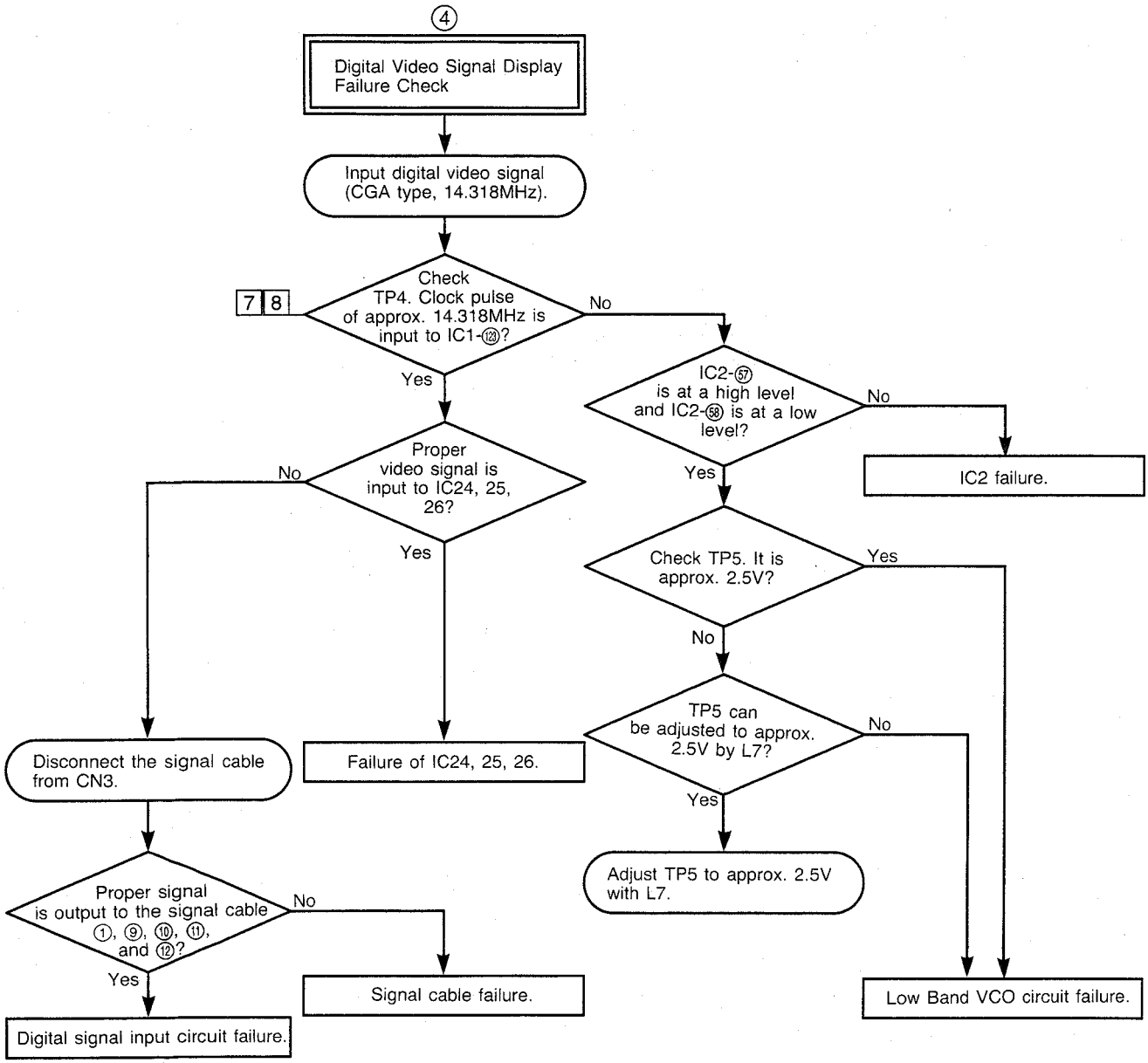
TROUBLESHOOTING CHART

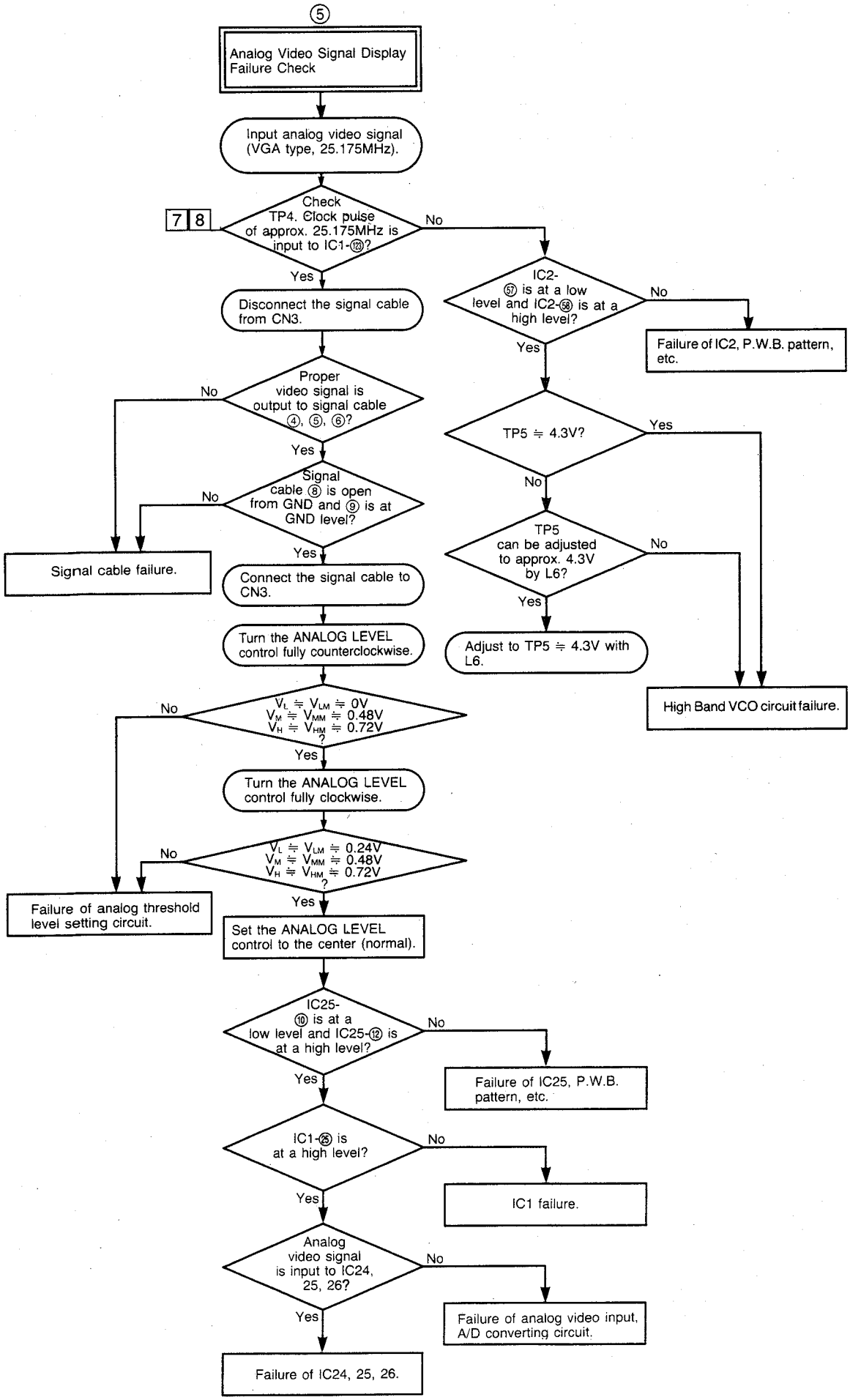


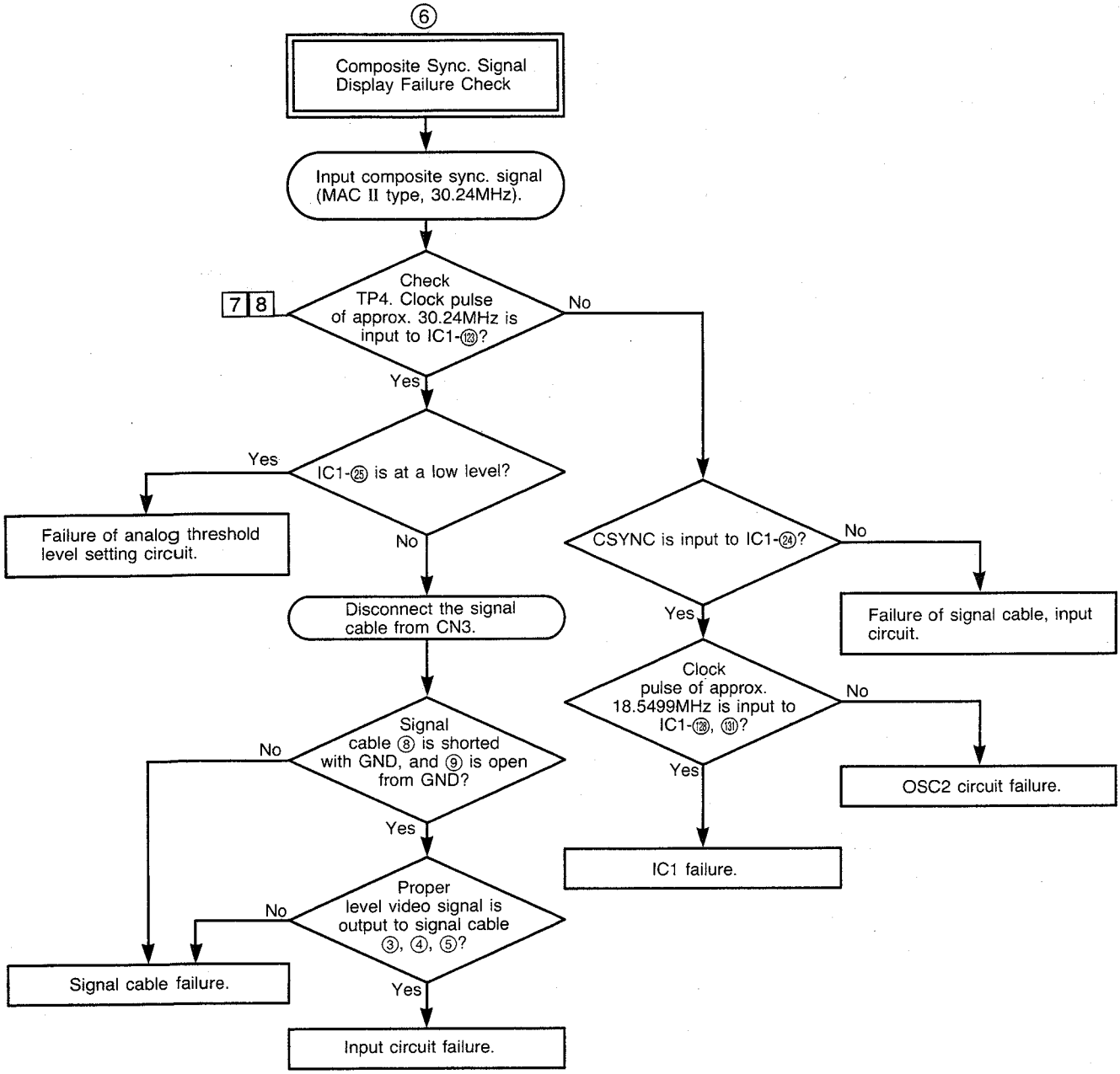

①
MPU Check
Press the RESET SW of the panel.
1
Clock pulse of approx. 7.987MHz is generated at IC2-㉝?
No
7.987MHz oscillating circuit failure (XTL, C67, 68, R73, IC2).
Yes
2
IC2-㊸ holds in low level for a specified period when the power is turned on and then turns into a constant high level?
No
Reset circuit failure (IC7 and its peripheral circuits, IC2).
Yes
3
IC2-㊺ and ⑭ are always at a high level by turning the power ON?
No
Power OFF detection circuit failure (IC9 and their peripheral circuits, IC2).
Yes
4
Clock pulse of approx. 2MHz is output to IC2-㉙?
No
IC2 failure.
Yes
Input digital video signals. (CGA type, 14.318MHz)
Press the RESET and MODE SELECT DOWN keys concurrently. (ALL RESET)
The phase LED alone is lit after all LEDs are once lit?
No
LED driver failure. (IC8, R64-67)
Yes
Press the RESET key. Select the H-pos mode with the MODE SELECT key.
Keep pressing the UP key.
The screen image moves in the horizontal direction smoothly?
No
Check if the P.W.B. pattern between IC1 and IC2 is normal. (Failure of soldering, etc.)
Yes
Check IC2-㊼, ㊿-㊹, and ㊾ and peripheral circuits.

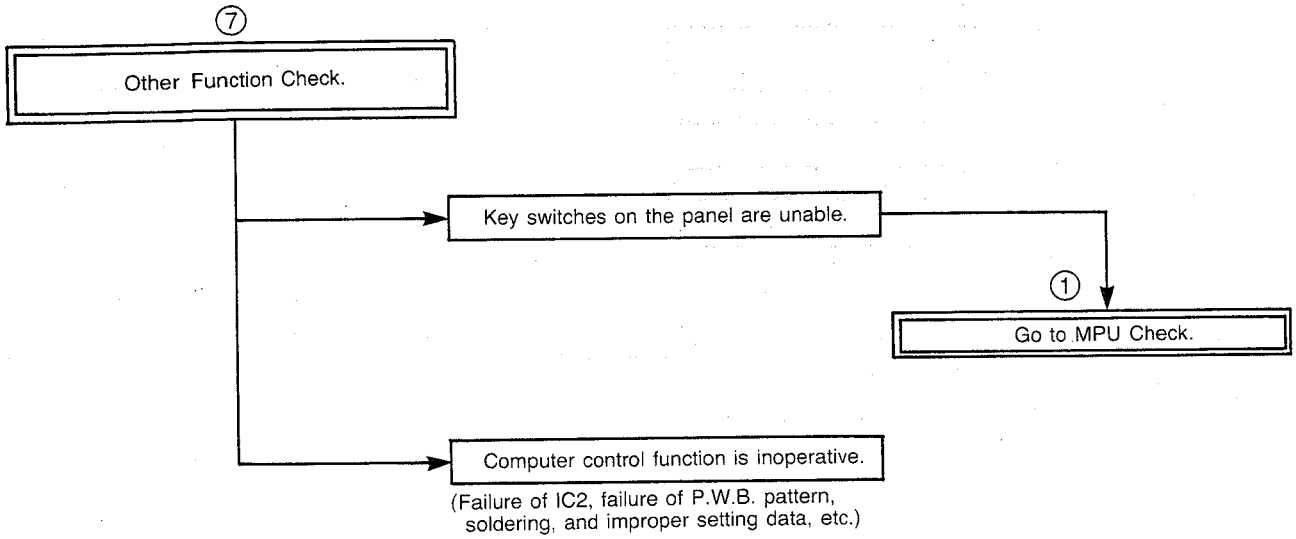

②
Power Source Circuit Check
Turn the power switch OFF.
The voltage between CN1 ①-③ (③ is GND) is approx. 12V?
No
AC adaptor failure.
Yes
Turn the power switch ON.
D1 cathode ≒ 12V?
No
F1 failure.
Yes
D2 cathode ≒ 12V?
No
F2 failure.
Yes
Check TP1 (V_{cpu}) ≒ 5.1V?
No
Yes
D3 anode ≒ 5.8V?
No
Yes
D3 failure.
Disconnect the LCD unit from CN5.
Check TP2 (V_c) ≒ 5V?
No
D4, 5, 6 failure.
Yes
Check TP3 (−5V) ≒ −5V?
No
Failure of DC-DC converter circuit for −5V.
Yes
LCD unit failure.
Yes
Check TP1 (V_{CPU}) ≒ 5.1V?
No
Failure of DC-DC converter circuit for +5V, V_{CPU} or V_C line short.
Check TP9 (V_{DD}) ≒ 12V?
No
Disconnect the LCD unit from CN5.
Yes
Check TP9 (V_{DD}) ≒ 12V?
Yes
LCD unit failure.
No
IC47-◎ voltage (V_{vco}) ≒ 10V?
No
Failure of IC47, C4, 6, 7, L7.
Yes
IC49-③ voltage ≒ 5V?
No
Failure of IC48, 49 and its peripheral parts.
Yes
CN2-① voltage (V_{FAN}) ≒ 12V?
No
Disconnect the fan motor unit from CN2.
Yes
Q8-emitter voltage ≒ 12V?
Yes
Failure of Q7, 8 and its peripheral parts.
No
Fan motor is operating?
Yes
No
CN2-② voltage (V_{FAN}) ≒ 12V?
Yes
No
Failure of L2, C3, C5.
Fan motor unit failure.
Failure of DC-DC converter circuit for +12V.
⑦
Go to Other Function Check


③
LCD Display Failure Check
Input digital video signal (CGA type, 14.318MHz).
5
Clock pulse of approx. 18.5499MHz is generated at IC3-⑬1?
No
OSC1 circuit failure.
Yes
Check TP4. Clock pulse of approx. 14.318MHz is generated at IC1-⑫8 ?
No
Yes
7 8
6 7 8
HSYNC is input to IC1-㉖ and VSYNC to ㉗?
No
Failure of HSYNC or VSYNC input circuit or signal cable failure.
Yes
Input signal to IC1-㉖ and output signal from IC1-⑫1 and ⑫2 have the same frequency?
No
Yes
Input signal to IC1-㉗ and output signal from IC1-㊾ have the same frequency?
No
Yes
Check for 61.326Hz on IC1-㊿?
No
Yes
Output from IC1-㊺ and ㊻ is high level?
No
Failure of IC1 and its peripheral.
Yes
Output from IC1-㊹ is high level?
No
Yes
Proper signal is input to IC1-㊼-㊿?
No
Failure of signal line between IC1 and IC2.
Yes
IC2-㊼ is at a high level and IC2-㊽ is at a low level?
No
①
Go to MPU Check.
Yes
IC8-⑫ is at a high level and IC8-⑪ is at a low level?
No
IC8 failure.
Yes
VCO circuit failure or pattern failure.
Signal of IC38-㉑, IC37-⑱, IC36-⑥ is normal?
No
Disconnect the panel.
Yes
Signal of IC38-㉑, IC37-⑱, IC36-⑥ are normal?
No
Yes
Panel failure.
Failure of IC36, 37, 38.
Proper video signal is input to IC3-⑧, ⑬, ⑭ and IC4-⑧, ⑬, ⑭?
No
Video signal input circuit failure.
Yes
Upper screen display is abnormal.
(Failure of IC1, 3, 4, 33, 34, 35, 36, 37, 39, 40, 41, 42, 43, 44, 45, 46, LCD unit, failure of P.W.B. pattern, soldering, etc.)
Lower screen display is abnormal.
(Failure of IC3, 4, 5, 6, LCD unit, failure of P.W.B. pattern, soldering, etc.)
No-display, abnormal display.
(Failure of IC1, 2, LCD unit, P.W.B. pattern open or short, device missing, abnormal material mixing, etc.)


④
Digital Video Signal Display Failure Check
Input digital video signal (CGA type, 14.318MHz).
7 8
Check TP4. Clock pulse of approx. 14.318MHz is input to IC1-⑫⑧?
No
Yes
IC2-⑤⑦ is at a high level and IC2-⑤⑧ is at a low level?
No
IC2 failure.
Yes
Proper video signal is input to IC24, 25, 26?
No
Yes
Check TP5. It is approx. 2.5V?
Yes
No
TP5 can be adjusted to approx. 2.5V by L7?
No
Yes
Adjust TP5 to approx. 2.5V with L7.
Disconnect the signal cable from CN3.
Failure of IC24, 25, 26.
Proper signal is output to the signal cable ①, ⑨, ⑩, ⑪, and ⑫?
No
Yes
Signal cable failure.
Digital signal input circuit failure.
Low Band VCO circuit failure.


⑤
Analog Video Signal Display Failure Check
Input analog video signal (VGA type, 25.175MHz).
7 8
Check TP4. Clock pulse of approx. 25.175MHz is input to IC1-⑫⑧?
No
Yes
Disconnect the signal cable from CN3.
Proper video signal is output to signal cable ④, ⑤, ⑥?
No
Yes
Signal cable ⑧ is open from GND and ⑨ is at GND level?
No
Yes
Signal cable failure.
Connect the signal cable to CN3.
Turn the ANALOG LEVEL control fully counterclockwise.
$V_L \fallingdotseq V_{LM} \fallingdotseq 0V$
$V_M \fallingdotseq V_{MM} \fallingdotseq 0.48V$
$V_H \fallingdotseq V_{HM} \fallingdotseq 0.72V$
?
No
Yes
Turn the ANALOG LEVEL control fully clockwise.
$V_L \fallingdotseq V_{LM} \fallingdotseq 0.24V$
$V_M \fallingdotseq V_{MM} \fallingdotseq 0.48V$
$V_H \fallingdotseq V_{HM} \fallingdotseq 0.72V$
?
No
Yes
Failure of analog threshold level setting circuit.
Set the ANALOG LEVEL control to the center (normal).
IC25-⑩ is at a low level and IC25-⑫ is at a high level?
No
Yes
Failure of IC25, P.W.B. pattern, etc.
IC1-㉕ is at a high level?
No
Yes
IC1 failure.
Analog video signal is input to IC24, 25, 26?
No
Yes
Failure of analog video input, A/D converting circuit.
Failure of IC24, 25, 26.
IC2-㊼ is at a low level and IC2-㊽ is at a high level?
No
Yes
Failure of IC2, P.W.B. pattern, etc.
TP5 ≒ 4.3V?
Yes
No
TP5 can be adjusted to approx. 4.3V by L6?
No
Yes
Adjust to TP5 ≒ 4.3V with L6.
High Band VCO circuit failure.


⑥
Composite Sync. Signal Display Failure Check
Input composite sync. signal (MAC II type, 30.24MHz).
7 8
Check TP4. Clock pulse of approx. 30.24MHz is input to IC1-⑫⑧?
No
Yes
Yes
IC1-㉕ is at a low level?
Failure of analog threshold level setting circuit.
No
Disconnect the signal cable from CN3.
Signal cable ⑧ is shorted with GND, and ⑨ is open from GND?
No
Yes
Proper level video signal is output to signal cable ③, ④, ⑤?
No
Signal cable failure.
Yes
Input circuit failure.
CSYNC is input to IC1-㉔?
No
Failure of signal cable, input circuit.
Yes
Clock pulse of approx. 18.5499MHz is input to IC1-⑫⑧, ⑬①?
No
OSC2 circuit failure.
Yes
IC1 failure.


⑦
Other Function Check.
Key switches on the panel are unable.
①
Go to MPU Check.
Computer control function is inoperative.
(Failure of IC2, failure of P.W.B. pattern,
soldering, and improper setting data, etc.)

[1] IC2-㉝
1V/div
50ns/div

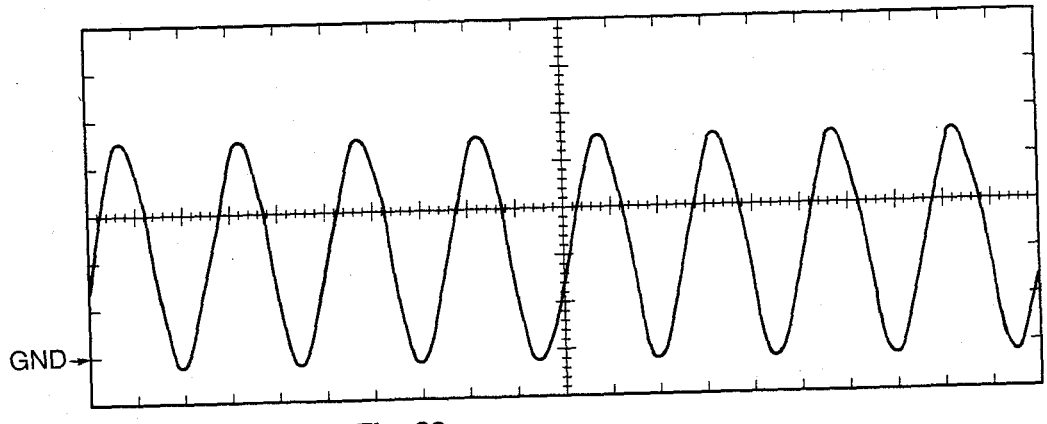


Fig. 22

[2] V_{cpu} ··· 2V/div
IC2-㊸ ··· 2V/div
5ms/div

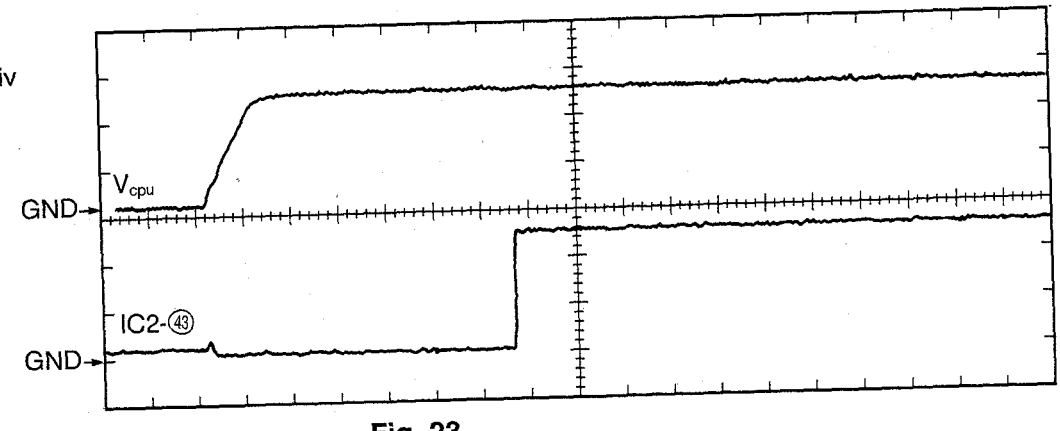


Fig. 23

[3] V_c ··· 2V/div
IC2-㊺ or ⑭
2V/div
10ms/div

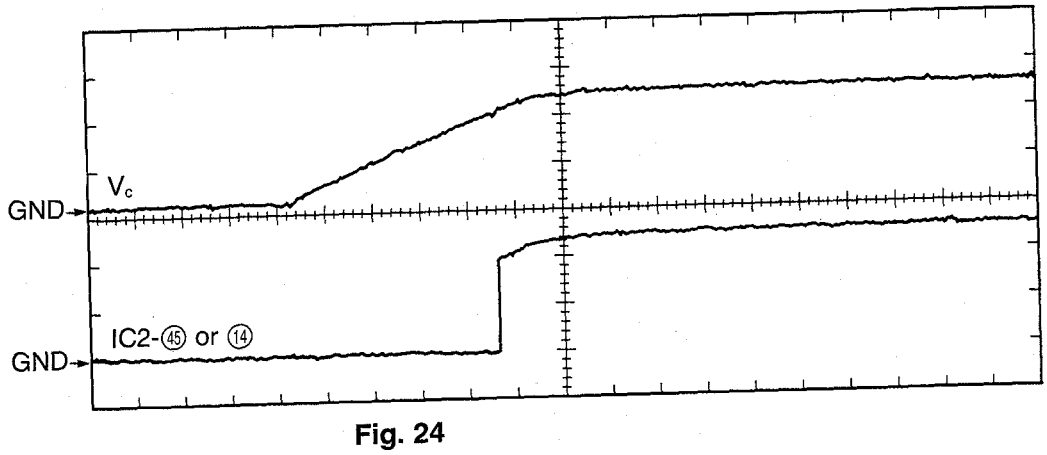


Fig. 24

[4] IC2-㉙ ··· 1V/div
100ns/div

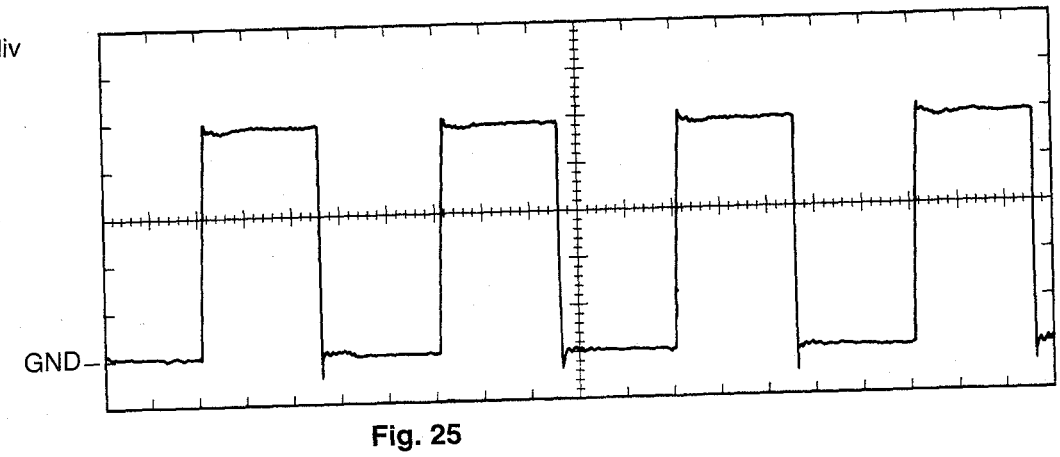


Fig. 25

5 IC1-㉘ or ㉛
1V/div
10ns/div

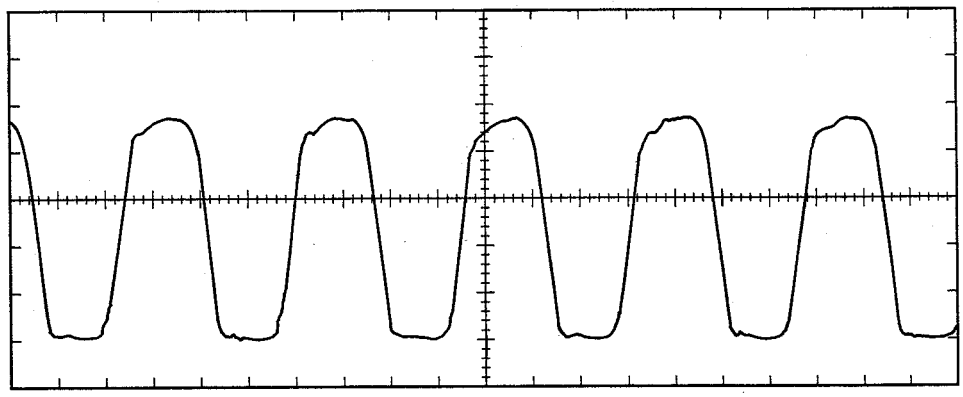


Fig. 26

6 IC1-㉗ ··· 2V/div
500ns/div

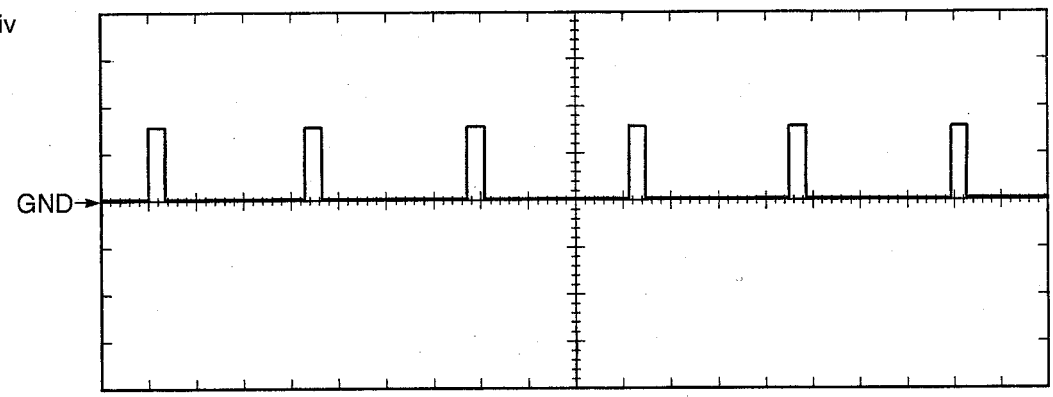


Fig. 27

7 IC1-㉗ ··· 2V/div
IC1-㉓ ··· 2V/div
50ns/div

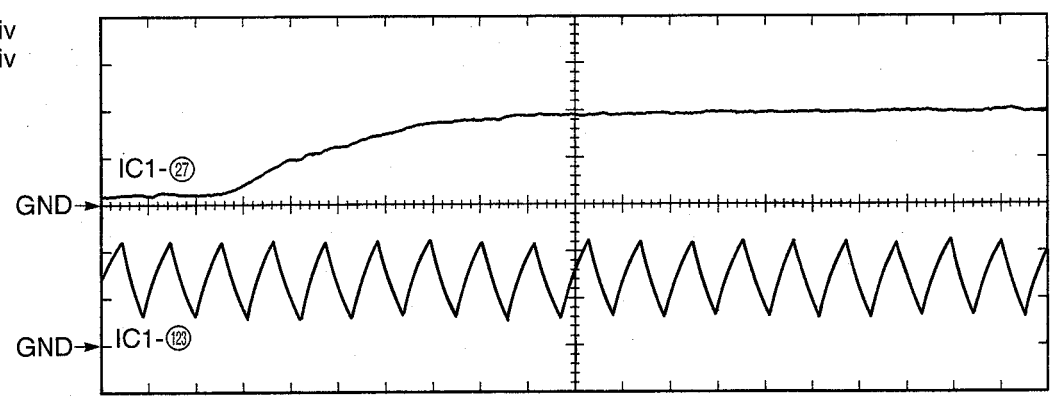


Fig. 28

8 IC1-㉔ or ㉖ ··· 2V/div
IC1-㉓ ··· 2V/div
20ns/div

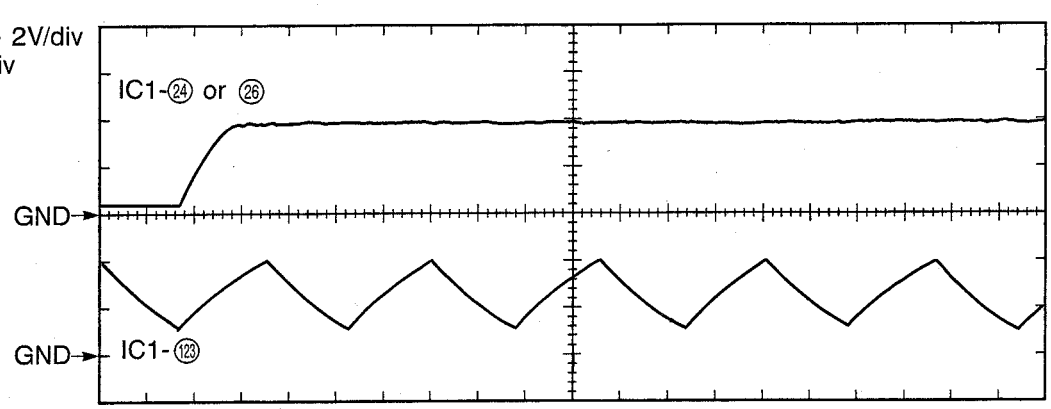
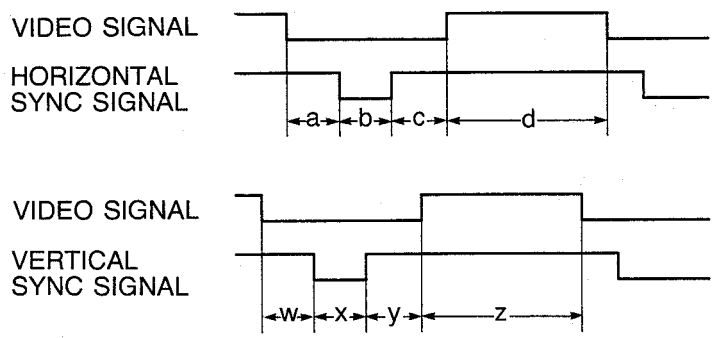
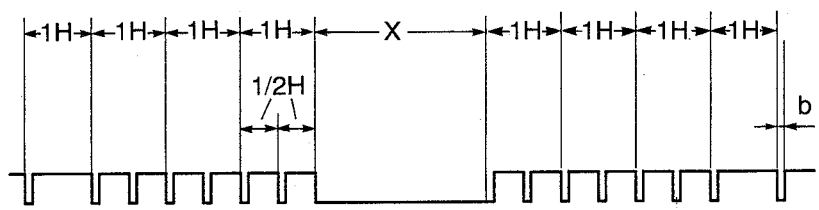


Fig. 29

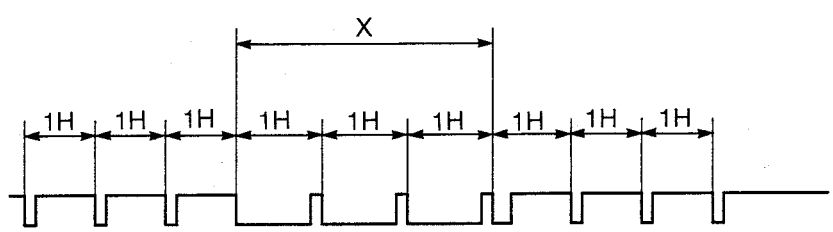
TIMING CHART

■ The following timing charts are applied to Tables 12, 13 and 14.





(Csync for Old MAC II)



(Csync for New MAC II)

Fig. 30

Table 12

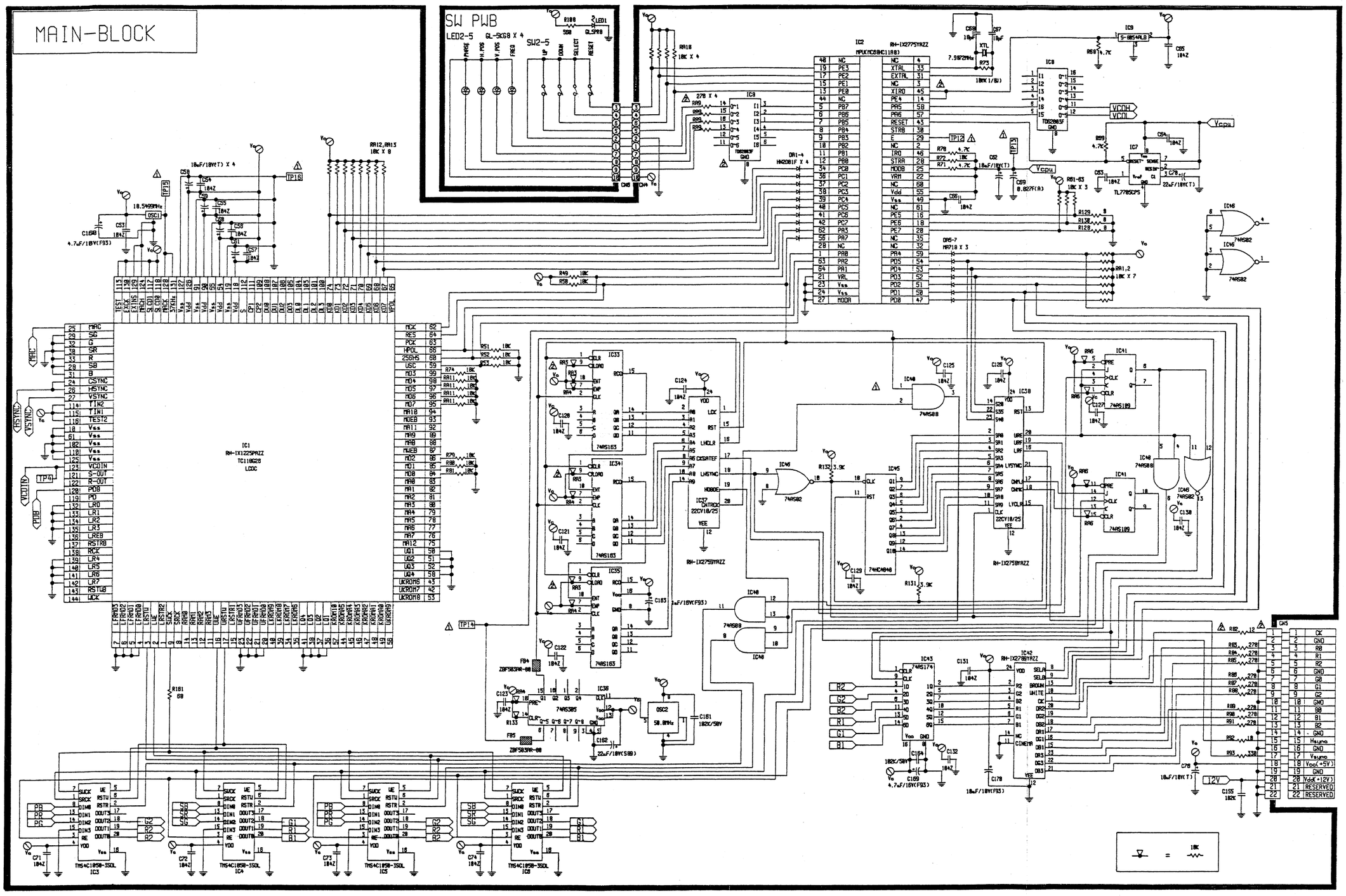
			1	2	3	4	5	6	7	8
			IBM				IBM		IBM	IBM
			VGA	VGA/MCGA		VGA	EGA		CGA	MDA
							Text 40chr	80chr/Graphic	40chr, Graphic/80chr	
			720 dot	640 dot			640 dot		640 dot	720 dot
			400 line	400 line	350 line	480 line	350 line		200 line	350 line
Hsync	FRONT PORCH a	dot	18	16			−7	−3	95/103	9
	SYNC b	dot	108	96			80	80	64/ 48	144
	BACK PORCH c	dot	54	48			39	27	113/121	9
	VIDEO PERIOD d	dot	720	640			640	640	640	720
	1H (a+b+c+d)	dot	900	800			752	744	912	882
		μs	31.777417	31.777557			46.256997	45.764901	63.696047	54.253552
	1 dot	ns	35.308241	39.721946			61.511964	61.511964	69.842157	61.511964
	1/H	KHz	31.468906	31.468881			21.618351	21.850806	15.699561	18.432197
	1/dot	MHz	28.322	25.175			16.257		14.318	16.257
	LEVEL		TTL	TTL			TTL		TTL	TTL
	SYNC POLARITY	+/−	−	−	+	−	+		+	+
Vsync	FRONT PORCH W	H	13	13	38	11	1		25	0
	SYNC X	H	2	2	2	2	13		3	16
	BACK PORCH Y	H	34	34	59	32	2		34	4
	VIDEO PERIOD Z	H	400	400	350	480	350		200	350
	1V (W+X+Y+Z)	H	449	449	449	525	366	366	262	370
		ms	14.26806	14.268123	14.268123	16.683217	16.930061	16.749954	16.688364	20.073814
	1/V	Hz	70.00	70.00	70.00	59.94	59.07	59.70	59.92	49.82
	LEVEL		TTL	TTL	TTL	TTL	TTL		TTL	TTL
	SYNC	+/−	+	+	−	−	−		+	−
VIDEO	LEVEL		0.7Vp-p MAX 75Ω Load				TTL		TTL	TTL
	TYPE		R, G, B				R, G, B r, g, b		R, G, B I	Mono Video I
REMARKS									● AUTO SETUP shall be set in the 40chr-graphic mode.	

Table 13

			9	10	11	12	13	14	15	
			Hercules		Hercules		APPLE		AT & T	
			HGC/HGC+		Incolor		MAC II Video Card	MAC +/SE	6300WGS	
			Text	Graphic	Text	Graphic				
			720 dot		720 dot		640 dot	512 dot	640 dot	
			350 line	348 line	350 line	348 line	480 line	342 line	350 line	400 line
Hsync	FRONT PORCH a	dot	7	−2	7	−2	64	15	78	
	SYNC b	dot	135	112	135	112	64	64	104	
	BACK PORCH c	dot	20	34	20	34	96	113	106	
	VIDEO PERIOD d	dot	720	720	720	720	640	512	640	
	1H (a+b+c+d)	dot	882	864	882	864	864	704	928	
		μs	55.125	54.000	46.42105	45.473684	28.571429	44.934641	38.666667	
	1 dot	ns	62.500		52.631579		33.068783	63.827614	41.666667	
	1/H	KHz	18.1406	18.5185	21.54195	21.990741	35.000	22.254545	25.862069	
	1/dot	MHz	16.000		19.000		30.240	15.6672	24.000	
	LEVEL		TTL		TTL		TTL	TTL	TTL	
	SYNC POLARITY	+/−	+		+		−	+	+	
Vsync	FRONT PORCH W	H	0		0		3	0	25	0
	SYNC X	H	16		16		3	4	16	16
	BACK PORCH Y	H	4	6	4	6	39	24	41	16
	VIDEO PERIOD Z	H	350	348	350	348	480	342	350	400
	1V (W+X+Y+Z)	H	370	370	370	370	525	370	432	
		ms	20.39625	19.980	17.175789	16.825263	15.000	16.625817	16.704	
	1/V	Hz	49.03	50.05	58.22	59.43	66.68	60.15	59.87	
	LEVEL		TTL		TTL		TTL	TTL	TTL	
	SYNC	+/−	−		−		−	+	+	
VIDEO	LEVEL		TTL		TTL		1.0Vp-p MAX 75Ω Load	TTL	TTL	
	TYPE		Mono Video I		R, G, B r, g, b		R, G, B	Mono Video I	R, G, B I	
REMARKS							● Signal cable is required. ● Synchronous signal is Csync.	● A/D converter adaptor is required.	● Signal cable is required. ● Operates in the 400 line mode also with 350 line signal input.	

Table 14

			16	17	18	19	20	21	22	23
			APPLE	NEC		SHARP				
			APPLE IIe/ +/c/GS	PC-9801		AX-286 AX-386				
			560 dot	640 dot		640 dot				
			192 line	200 line	400 line	480 line				
Hsync	FRONT PORCH a	dot	109	59	59	18				
	SYNC b	dot	170	64	64	88				
	BACK PORCH c	dot	73	133	85	86				
	VIDEO PERIOD d	dot	560	640	640	640				
	1H (a+b+c+d)	dot	912	896	848	832				
		μs	63.696047	62.578572	40.280060	33.048659				
	1 dot	ns	69.842157	69.842157	47.500071	39.721946				
	1/H	KHz	15.699561	15.979911	24.826179	30.258				
	1/dot	MHz	14.318	14.318	21.0526	25.175				
	LEVEL		TTL	TTL		TTL				
	SYNC POLARITY	+/−	+	−		+				
Vsync	FRONT PORCH W	H	33	15	7	4				
	SYNC X	H	3	8	8	12				
	BACK PORCH Y	H	34	37	25	5				
	VIDEO PERIOD Z	H	192	200	400	480				
	1V (W+X+Y+Z)	H	262	260	440	501				
		ms	16.688364	16.270429	17.723227	16.557379				
	1/V	Hz	59.92	61.46	56.42	60.40				
	LEVEL		TTL	TTL		TTL				
	SYNC	+/−	+	−		−				
VIDEO	LEVEL		TTL	TTL		TTL				
	TYPE		R, G, B I	R, G, B		R, G, B r, g, b				
REMARKS			Composite signal-responsive A/D converter adaptor is separately required. Shall be operated in the IBM CGA mode.	Signal cable is required.						


MAIN-BLOCK
SW PWB
LED2-5
GL-5KG8 X 4
SW2-5
IC1
RH-IX1225PAZZ
TC118628
LCDC
IC2
MPUK(C88C11A8)
RH-IX1277SAZZ
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC33
IC34
IC35
IC36
IC37
IC38
IC39
IC40
IC41
IC42
IC43
IC44
IC45
IC46
IC47
IC48
IC49
74HC4040
74HC4538
74HC4538
74HC4538

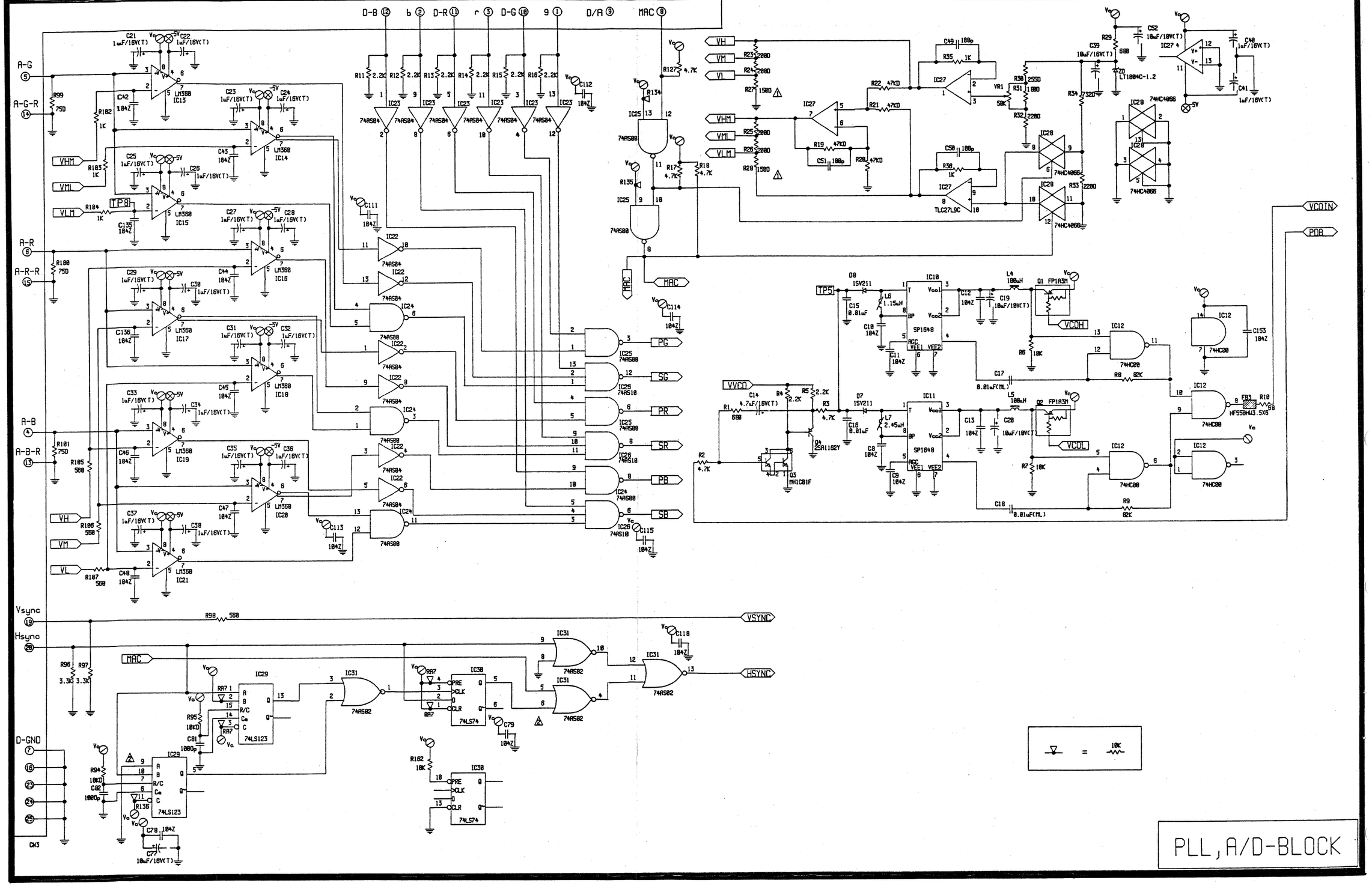


Fig. 32 CIRCUIT DIAGRAM (PLL, A/D-BLOCK)

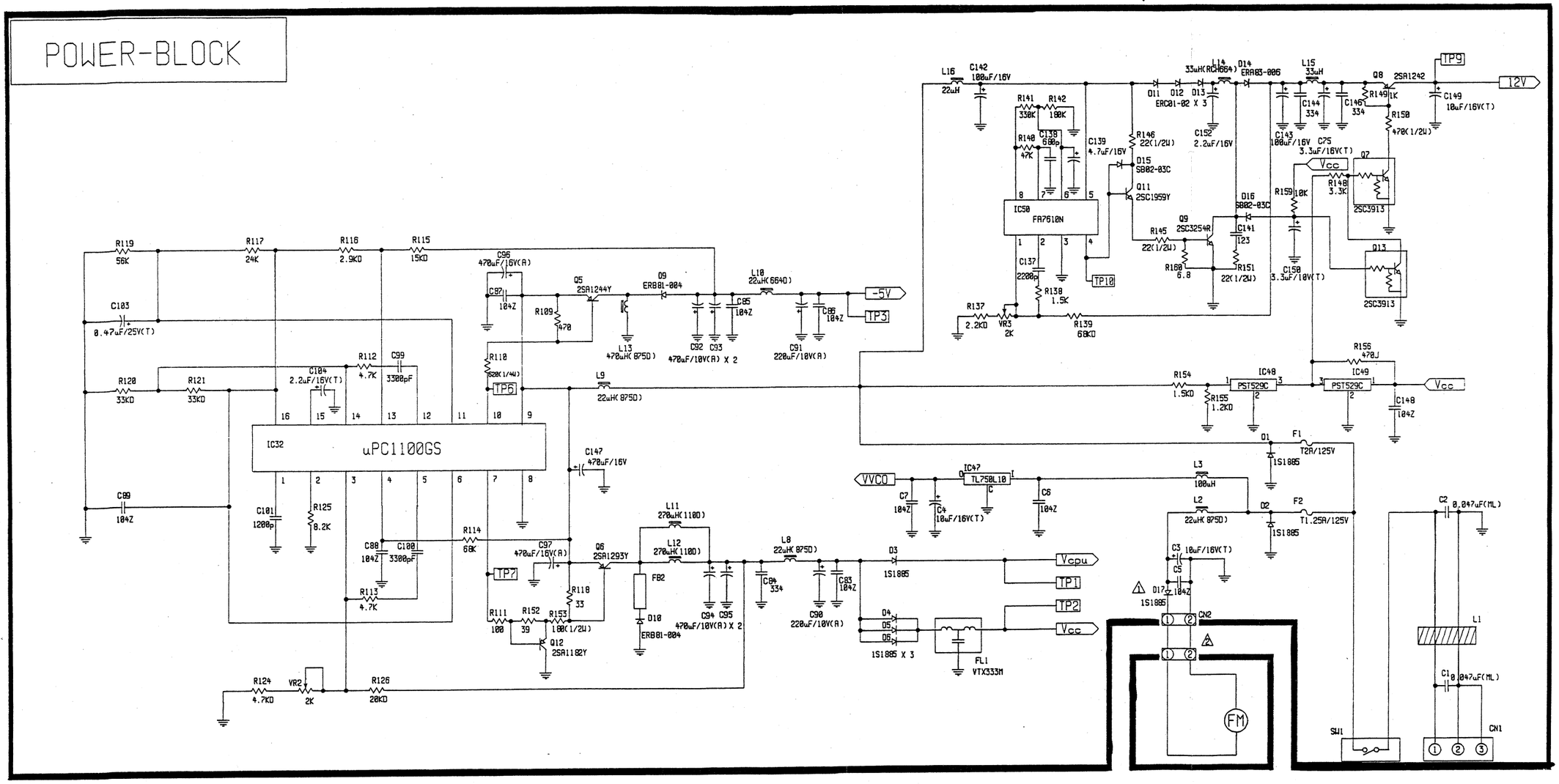
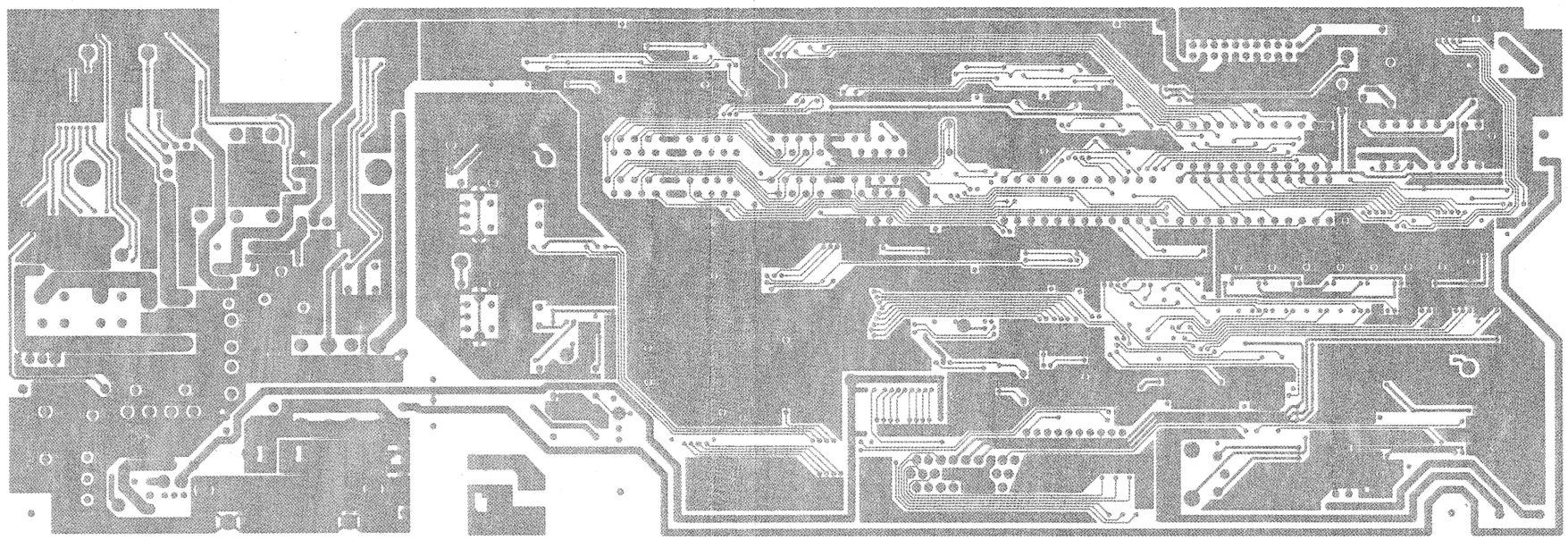


Fig. 33 CIRCUIT DIAGRAM (POWER-BLOCK)



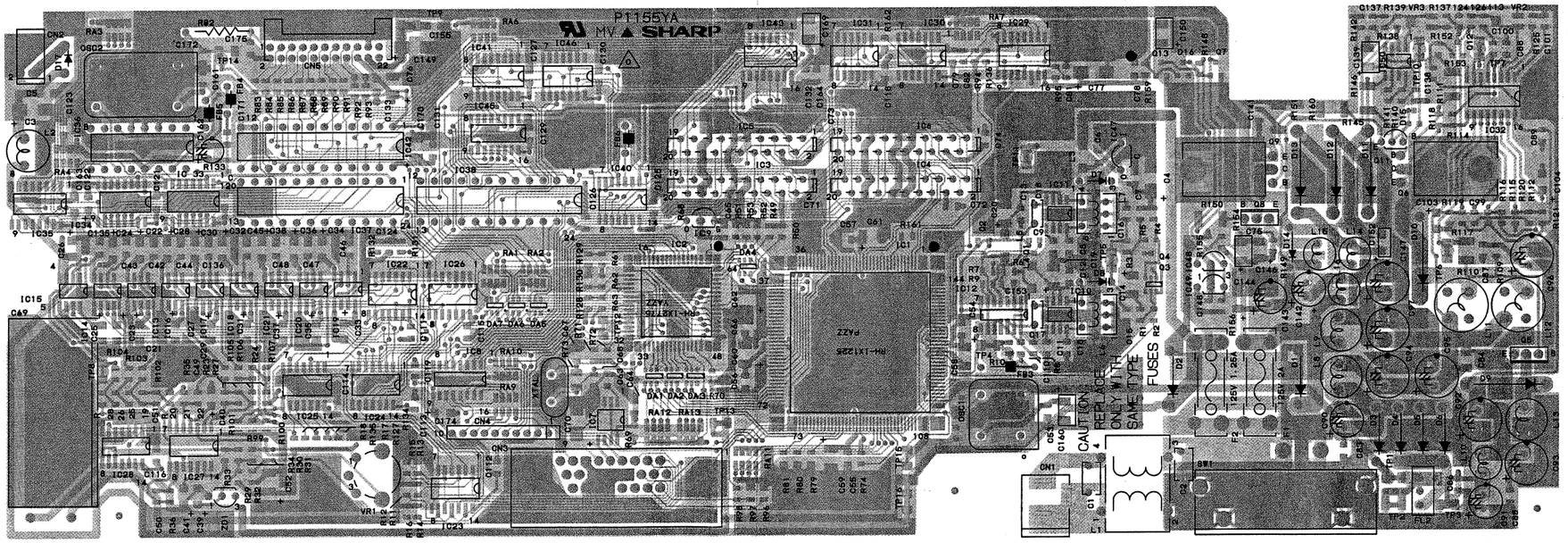


Fig. 34 P.W.B. PATTERN

REPLACEMENT PARTS LIST

"HOW TO ORDER REPLACEMENT PARTS"

To have your order filled promptly and correctly, please furnish the following information.

1. MODEL NUMBER
2. REF. NO.
3. PART NO.
4. DESCRIPTION

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
1. LCD, FAN						
1-1	LCD	DUNTL2072YAZZ	N	LCD UNIT (LQ10P01)	1	**
1-2	FAN	DFUNP0002YAZZ	N	FAN MOTOR	1	BF
2. IC						
2-1	IC1	RH-IX1225PAZZ		TC110G26	1	BF
2-2	IC2	RH-IX2775YAZZ	N	MC68HC11A8FU	1	AY
2-3	IC3~6	RH-IX1232PAZZ		TMS4C1050-3SDL	4	BG
2-4	IC7	RH-IX0855PAZZ		TL7705CPS-B (T)	1	AK
2-5	IC8	RH-IX2765YAZZ	N	TD62003F (T)	1	AF
2-6	IC9	RH-IX0847PAZZ		S-8054ALB	1	AE
2-7	IC10, 11	RH-IX1235PAZZ		SP1648MPT (T)	2	AT
2-8	IC12	RH-IX1239PAZZ		MM74HC00M (T)	1	AC
2-9	IC13~21	RH-IX1238PAZZ		LM360M (T)	9	AK
2-10	IC22, 23	RH-IX1241PAZZ		SN74AS04NS (T)	2	AD
2-11	IC24, 25	RH-IX2766YAZZ	N	SN74AS00NS (T)	2	AD
2-12	IC26	RH-IX2767YAZZ	N	SN74AS10NS (T)	1	AE
2-13	IC27	RH-IX1236PAZZ		TLC27L9CNS (T)	1	AR
2-14	IC28	RH-IX1244PAZZ		μPD74HC4066G (T)	1	AE
2-15	IC29	RH-IX1284PAZZ		SN74LS123NS (T)	1	AE
2-16	IC30	RH-IX1133PAZZ		SN74LS74ANS (T)	1	AC
2-17	IC31, 46	RH-IX1285PAZZ		SN74AS02NS (T)	2	AD
2-18	IC32	RH-IX1234PAZZ		μPC1100GS (T)	1	AL
2-19	IC33~35	RH-IX2768YAZZ	N	SN74AS163NS (T)	3	AH
2-20	IC36	RH-IX2769YAZZ	N	SN74AS305N	1	BA
2-21	IC37	RH-IX2759YAZZ	N	22CV10/25-PLD12	1	AY
2-22	IC38	RH-IX2758YAZZ	N	22CV10/25-PLD13	1	AY
2-23	IC40	RH-IX1240PAZZ		SN74AS08NS (T)	1	AE
2-24	IC41	RH-IX2771YAZZ	N	SN74AS109NS (T)	1	AF
2-25	IC42	RH-IX2793YAZZ	N	BPAL22V10ACNT-PLD11	1	AY

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
2-26	IC43	RH-IX2772YAZZ	N	SN74AS174NS (T)	1	AL
2-27	IC45	RH-IX2774YAZZ	N	μPD74HC4040G (T)	1	AF
2-28	IC47	RH-IX1233PAZZ		TL750L10CLP	1	AL
2-29	IC48, 49	RH-IX2788YAZZ	N	PST529C	2	AF
2-30	IC50	RH-IX2778YAZZ	N	FA7610N (T)	1	AH
3. Transistor						
3-1	Q1, 2	VSFP1A3M///-1		FP1A3M (T)	2	AD
3-2	Q3	VSHN1C01FY/-1		HN1C01F-Y (T)	1	AB
3-3	Q4	VC2SA1162SY-1		2SA1162Y (T)	1	AA
3-4	Q5	VS2SA1244Y/1E		2SA1244Y	1	AE
3-5	Q6	VS2SA1293Y/1E		2SA1293Y	1	AF
3-6	Q7, 13	VS2SC3913//-1	N	2SC3913 (T)	2	AB
3-7	Q8	VS2SA1242Y/-1	N	2SA1242Y	1	AD
3-8	Q9	VS2SC3254R/-1	N	2SC3254R	1	AE
3-9	Q11	VS2SC1959-Y-1	N	2SC1959Y	1	AB
3-10	Q12	VS2SA1182-Y-1	N	2SA1182Y (T)	1	AB
4. Diode						
4-1	D1~6, 17	VHD1S1855//-1		1S1855	7	AB
4-2	D7, 8	VHD1SV211//-1		1SV211	2	AB
4-3	D9, 10	VHDERB81-004/		ERB81-004	2	AD
4-4	D11~13	VHDERC01-02-1	N	ERC01-02	3	AC
4-5	D14	VHDERA83-006/	N	ERA83-006	1	AC
4-6	D15, 16	VHDSB0203C/-1	N	SB02-03C (T)	2	AB
4-7	ZD	VHELT1004CZ-1		LT1004CZ	1	AM
4-8	DA1~4	VHDHN2D01F/-1		HN2D01F (T)	4	AC
4-9	DA5~7	VHDMA718///-1	N	MA718 (T)	3	AC
4-10	LED1	RH-PX2134YAZZ	N	LED GL5PR8	1	AB
4-11	LED2~5	RH-PX2154YAZZ	N	LED GL5KG8	4	AB
5. Coil						
5-1	L1	RTRNZ0306PAZZ		FERRITE CORE	1	AE
5-2	L2, 8, 9	RCILZ3877PAZZ		RCR-875D 22μH	3	AD
5-3	L3~5	VP-VD101K0000		LEM4532 (T)	3	AB

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
5-4	L6	RCILZ3874PAZZ		7KLT 1.15μH	1	AC
5-5	L7	RCILZ3875PAZZ		7KLT 2.45μH	1	AC
5-6	L10, 16	RCILZ3880PAZZ		RCR-664D 22μH	2	AC
5-7	L11, 12	RCILZ3878PAZZ		RCR-110D 270μH	2	AE
5-8	L13	RCILZ3876PAZZ		RCR-875D 470μH	1	AD
5-9	L14, 15	RCILZ2105YAZZ	N	RCH-664 33μH	2	AD
6. Oscilator, Core, Filter						
6-1	OSC1	RCRSZ0041PAZZ		XTAL 18.5499MHz	1	AN
6-2	OSC2	RCRS-2100YAZZ	N	XTAL 50.000MHz	1	AM
6-3	XTL	RCRSZ0043PAZZ		XTAL 7.9872MHz	1	AF
6-4	FB2	RCORF0042PAZZ		FERRITE BEAD	1	AA
6-5	FB3~5	RCORF2005YAZZ	N	FERRITE BEAD	3	AB
6-6	FL1	RMPT-2044YAZZ	N	FILTER (VTX333M)	1	AD
7. Fuse, Fuse Holder						
7-1	F1	QFS-F0003PAZZ	N	FUSE (125V/2.0A)	1	AD
7-2	F2	QFS-B0006PAZZ		FUSE (125V/1.25A)	1	AC
7-3		QFSHA2008YAZZ		FUSE HOLDER	4	AA
8. SW, VR						
8-1	SW1	QSW-C2088YAZZ	N	POWER SWITCH	1	AF
8-2	VR1	RVR-M0233PAZZ		VR 50K	1	AE
8-3	VR2, 3	RVR-M0232PAZZ		CHIP VR 2K	2	AC
9. Plug, Connector						
9-1	CN1	QSOCZ0115PAZZ		DC JACK	1	AC
9-2	CN2	QPLGJ0010PAZZ		CONNECTOR (2P) FOR FAN	1	AB
9-3	CN3	QPLGZ0410PAZZ		D SUB CONNECTOR (26P)	1	AV
9-4	CN4	QCNCM2528YAZZ	N	CONNECTOR ASSEMBLY	1	AL
9-5	CN5	QPLGJ2683YAZZ	N	CONNECTOR (22P)	1	AK
9-6	CN6	QPLGZ0415PAZZ	N	CONNECTOR (10P)	1	AC

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
10. Resistor						
10-1	R1, 29	VRS-TW2AD681J		TW)1/10W-680J	2	AA
10-2	R2, 3, 17, 18, 68~71, 112, 113, 127	VRS-TW2AD472J		TW)1/10W-4.7KJ	11	AA
10-3	R4, 5, 11~16	VRS-TW2AD222J		TW)1/10W-2.2KJ	8	AA
10-4	R6, 7, 49~53, 61~63, 72, 74, 79~81, 133~136, 159, 162	VRS-TW2AD103J		TW)1/10W-10KJ	21	AA
10-5	R8, 9	VRS-TW2AD823J		TW)1/10W-82KJ	2	AA
10-6	R10, 161	VRS-TW2AD680J		TW)1/10W-68J	2	AA
10-7	R19~22	RR-TV2AD4702D		TV)1/10W-47KD	4	AA
10-8	R23~26	RR-TV2AD2000D	N	TV)1/10W-200D	4	AA
10-9	R27, 28	RR-TV2AD1500D	N	TV)1/10W-150D	2	AA
10-10	R30	RR-TV2AD2550D	N	TV)1/10W-255D	1	AA
10-11	R31	RR-TV2AD1800D	N	TV)1/10W-180D	1	AA
10-12	R32, 33	RR-TV2AD2200D		TV)1/10W-220D	2	AA
10-13	R34	RR-TV2AD7320D		TV)1/10W-732D	1	AA
10-14	R35, 36, 102~104, 149	VRS-TW2AD102J		TW)1/10W-1KJ	6	AA
10-15	R73	VRS-TQ2BD106J		TQ)1/8W-10MJ	1	AA
10-16	R82	VRD-ST2DF120J		ST)1/5W-12J	1	AA
10-17	R83~91	VRS-TW2AD271J	N	TW)1/10W-270J	9	AA
10-18	R92	VRS-TW2AD100J		TW)1/10W-10J	1	AA
10-19	R93	VRS-TW2AD331J		TW)1/10W-330J	1	AA
10-20	R94, 95	RR-TV2AD1002D		TV)1/10W-10KD	2	AA
10-21	R96, 97, 148	VRS-TW2AD332J		TW)1/10W-3.3KJ	3	AA
10-22	R98, 105~107	VRS-TW2AD561J		TW)1/10W-560J	4	AA
10-23	R99~101	RR-TV2AD75R0D		TV)1/10W-75D	3	AA
10-24	R108	VRD-ST2DF561J	N	ST)1/5W-560J	1	AA
10-25	R109, 156	VRS-TW2AD471J		TW)1/10W-470J	2	AA
10-26	R110	VRS-TW2ED621J		TW)1/4W-620J	1	AA
10-27	R111	VRS-TW2AD101J	N	TW)1/10W-100J	1	AA
10-28	R114	VRS-TW2AD683J		TW)1/10W-68KJ	1	AA
10-29	R115	RR-TV2AD1502D		TV)1/10W-15KD	1	AA
10-30	R116	RR-TV2AD2941D		TV)1/10W-2.94KD	1	AA

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
10-31	R117	VRS-TW2AD243J		TW)1/10W-24KJ	1	AA
10-32	R118	VRS-TW2AD330J		TW)1/10W-33J	1	AA
10-33	R119	VRS-TW2AD563J		TW)1/10W-56KJ	1	AA
10-34	R120, 121	RR-TV2AD3302D		TV)1/10W-33KD	2	AA
10-35	R124	RR-TV2AD4701D		TV)1/10W-4.7KD	1	AA
10-36	R125	VRS-TW2AD822J		TW)1/10W-8.2KJ	1	AA
10-37	R126	RR-TV2AD2002D		TV)1/10W-20KD	1	AA
10-38	R128, 129	VRS-TW2AD0000	N	TW)1/10W-0000	2	AA
10-39	R131, 132	VRS-TW2AD392J	N	TW)1/10W-3.9KJ	2	AA
10-40	R137	RR-TV2AD2201D	N	TW)1/10W-2.2KD	1	AA
10-41	R138	VRS-TW2AD152J	N	TW)1/10W-1.5KJ	1	AA
10-42	R139	RR-TV2AD6802D	N	TW)1/10W-68KD	1	AA
10-43	R140	VRS-TW2AD473J	N	TW)1/10W-47KJ	1	AA
10-44	R141	VRS-TW2AD334J	N	TW)1/10W-330KJ	1	AA
10-45	R142	VRS-TW2AD184J		TW)1/10W-180KJ	1	AA
10-46	R145, 146, 151	VRS-TW2HD220J	N	TW)1/2W-22J	3	AA
10-47	R150	VRS-TW2HD471J	N	TW)1/2W-470J	1	AA
10-48	R152	VRS-TW2AD390J	N	TW)1/10W-39J	1	AA
10-49	R153	VRS-TW2HD181J	N	TW)1/2W-180J	1	AA
10-50	R154	RR-TV2AD1501D	N	TV)1/10W-1.5KD	1	AA
10-51	R155	RR-TV2AD1201D	N	TV)1/10W-1.2KD	1	AA
10-52	R160	VRS-TW2AD6R8J	N	TW)1/10W-6.8J	1	AA
10-53	RA1~4, 6, 7, 10~13	RR-KZ2195YAZZ	N	1/16W-10KJ	10	AB
10-54	RA9	RR-KZ2249YAZZ	N	1/16W-390J	1	AB
11. Capacitor						
11-1	C1, 2	RC-QZS473AFYK		FILM 0.047μF/K/50V	2	AA
11-2	C3, 4, 77, 149	VCSATD1CE106M		F93 10μF/16V	4	AE
11-3	C5~13, 42~48, 53~57, 63~66, 71~74, 78, 79, 83, 85~89, 110~127, 129~133, 135, 136, 148, 153	VCKZTV1EF104Z		F/0.1μF/Z/25V	64	AA

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
11-4	C14, 139, 160, 169	VCSATH1CE475M		F93 4.7μF/16V	4	AC
11-5	C15, 16	VCKYTV1HB103K		CERAMIC B/0.01μF/K/50V	2	AA
11-6	C17, 18	RC-QZS103AFYK		FILM 0.01μF/K/50V	2	AA
11-7	C19, 20, 52, 58 ~62, 76, 170	VCSATH1AE106M		F93 10μV/10V	10	AD
11-8	C21~41, 163	VCSATD1CE105M		F93 1μF/16V	22	AB
11-9	C49~51	VCCCTV1H3101J		CERAMIC CH/100pF/J/50V	3	AA
11-10	C67, 68	VCCCTV1H3180J		CERAMIC CH/18pF/J/50V	2	AA
11-11	C69	RC-EZ0133PAZZ		JB 27mF/5.5V	1	AF
11-12	C70	VCSATH1AE226M		F93 22μF/10V	1	AD
11-13	C75, 150	VCSATD1CE335M	N	F93 3.3μF/16V	2	AC
11-14	C81, 82, 155, 161, 164	VCKYTV1HB102K		CERAMIC B/0.001μF/K/50V	5	AA
11-15	C84, 144, 146	VCKYTQ1EF334Z	N	F/0.33μF/Z/25V	3	AB
11-16	C90, 91	RC-EZ0186PAZZ		RS 220μF/10V	2	AB
11-17	C92~95	RC-EZ0185PAZZ		RS 470μF/10V	4	AB
11-18	C96, 97, 147	RC-EZ2578YAZZ	N	VR 470μF/16V	3	AB
11-19	C99, 100	VCKYTV1HB332K		B/3300pF/K/50V	2	AA
11-20	C101	VCKYTV1HB122K		B/1200pF/K/50V	1	AA
11-21	C103	VCSATD1EE474M		F93 0.47μF/25V	1	AB
11-22	C104, 152	VCSATH1CE225M		F93 2.2μF/16V	2	AC
11-23	C137	VCKYTV1HB222K	N	B/2200pF/K/50V	1	AA
11-24	C138	VCCCTV1H3681J	N	CH/680pF/J/50V	1	AA
11-25	C141	VCKYTV1HB123K	N	B/0.012μF/K/50V	1	AA
11-26	C142, 143	RC-EZ2577YAZZ	N	PL 100μF/16V	2	AB
11-27	C162	RC-SZA226M1A/	N	S89 22μF/10V	1	AD

CABINET PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
12-1	Fig.35-①	DCABA2001YASA	N	CABINET ASSEMBLY A	1	BN
12-2	②	DCABB2002YASA	N	CABINET ASSEMBLY B	1	BC
12-3	③	GWAKP2001YASA	N	OPERATION FRAME	1	AR
12-4	④	GCOVA2005YASA	N	SMOKED COVER	1	AP
12-5	⑤	DFLM-2001YASA	N	ALUMINIUM FRAME ASSEMBLY A	2	AW
12-6	⑥	LFRM-2003YASA	N	ALUMINIUM FRAME C	1	AW
12-7	⑦	JBTN-0799PASA		KNOB FOR VR	1	AB
12-8	⑧	LANGK2030YAZZ	N	ANGLE	1	AD
12-9	⑨	MSPRP2001YASA	N	RUBBER KEY	1	AH
12-10	⑩	PGLSN2001YASA	N	GLASS A	1	BC
12-11	⑪	PGLSN2002YASA	N	GLASS B	1	AS
12-12	⑫	XYBSF30P10000		SCREW ϕ3×10S	10	AA
12-13	⑬	XYBSD30P08000		SCREW ϕ3×8S	9	AA
12-14	⑭	XBNSF30P08000	N	SCREW M3×8S	6	AA
12-15	⑮	XQBSF30P08000		SCREW M3×8S	4	AA
12-16	⑯	XWHSD35-10140	N	WASHER	1	AA
12-17	⑰	LX-WZ2003YAZZ	N	POLY SLIDER	1	AC
12-18	⑱	PSHEG2074YAZZ	N	INSULATION SHEET	1	AG

OTHERS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
13-1		DADP-0042PAZZ		AC ADAPTOR (SEC, SECL)	1	BM
13-2		DADP-2001YAZZ	N	AC ADAPTOR (SEEG)	1	BW
13-3		DSOCZ2001YAZZ	N	9P RGB CABLE	1	BE
13-4		DSOCZ2002YAZZ	N	15P RGB CABLE	1	BK
13-5		DCNCM2529YAZZ	N	LCD CABLE (22P)	1	AX
13-6		TLABZ2088YAZZ	N	AC ADAPTOR CAUTION LABEL	1	AC
13-7		TINSE2021YAZZ	N	OPERATION MANUAL 〈E〉 (SEC)	1	AV
13-8		TINSE2022YAZZ	N	OPERATION MANUAL 〈E〉 (SECL)	1	AW
13-9		TINSF2023YAZZ	N	OPERATION MANUAL 〈F〉 (SECL)	1	AX
13-10		TINSL2024YAZZ	N	OPERATION MANUAL 〈E,D,F,I〉 (SEEG)	1	AX

NOT REPLACEMENT ITEM

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
14-1		DPWB-2054YAZZ	N	MAIN P.W.B. ASSEMBLY	1	**
14-2		DPWB-2055YAZZ	N	SWITCH P.W.B. ASSEMBLY	1	BP

ASSEMBLING DRAWINGS

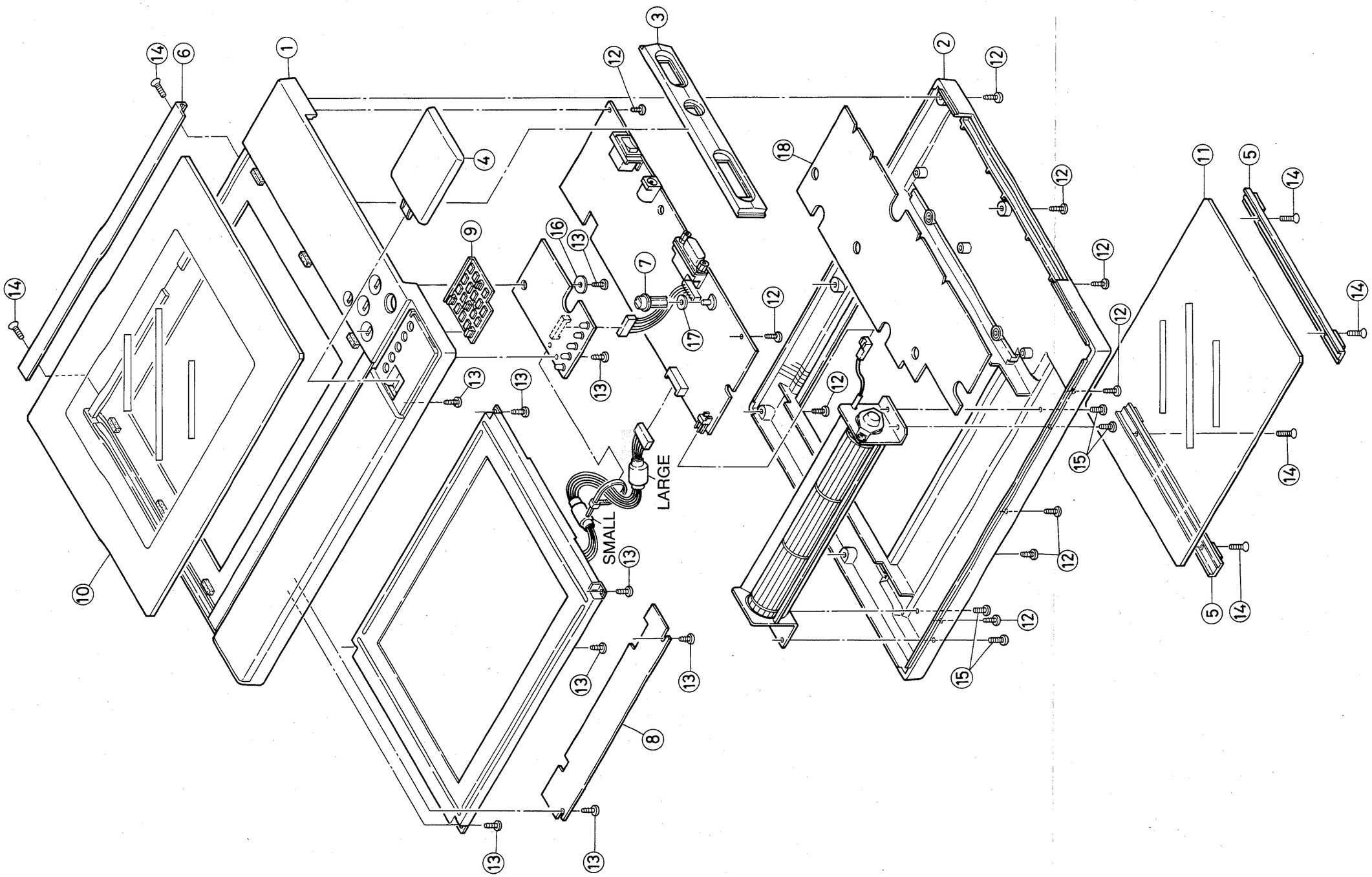


Fig. 35 CABINET PARTS

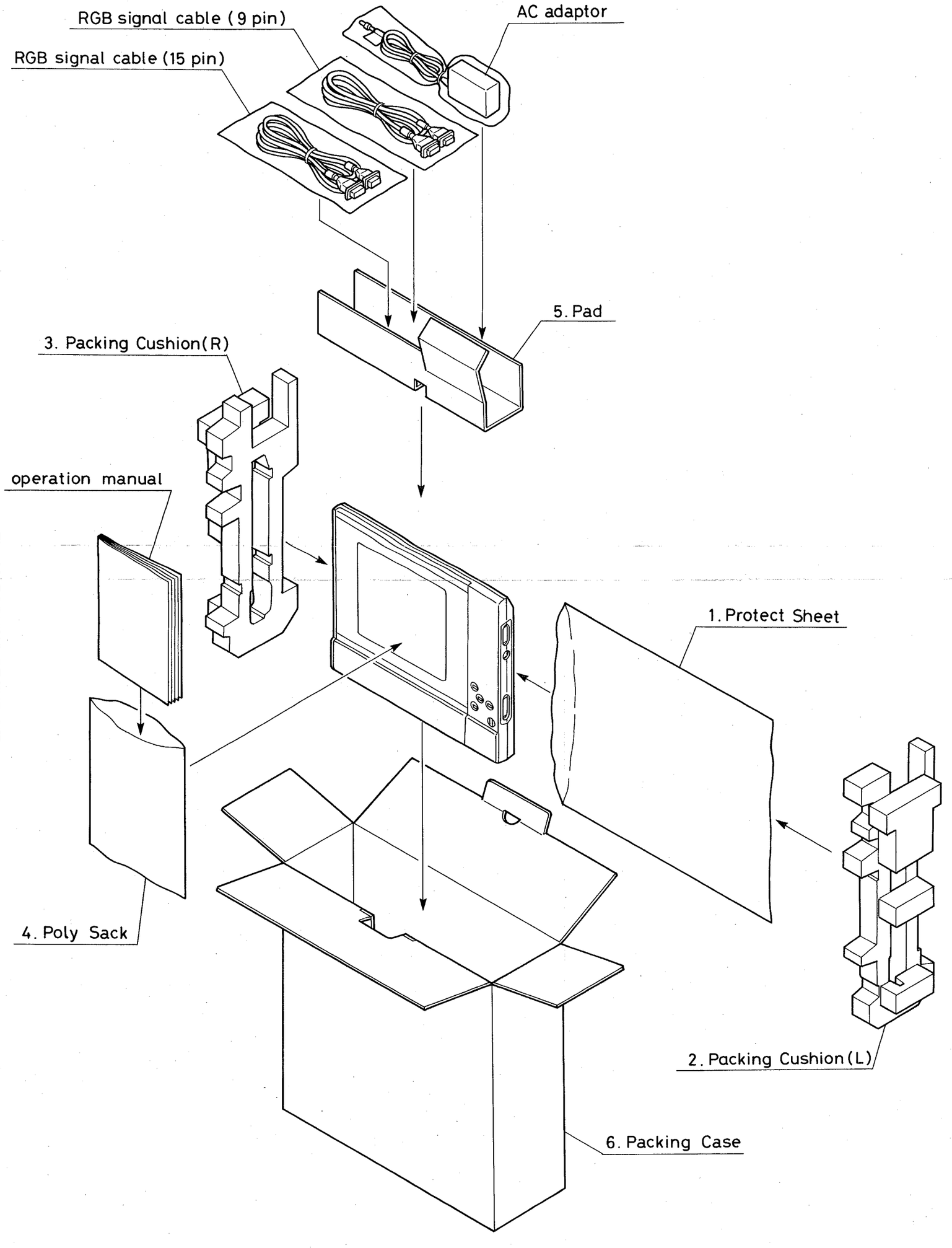
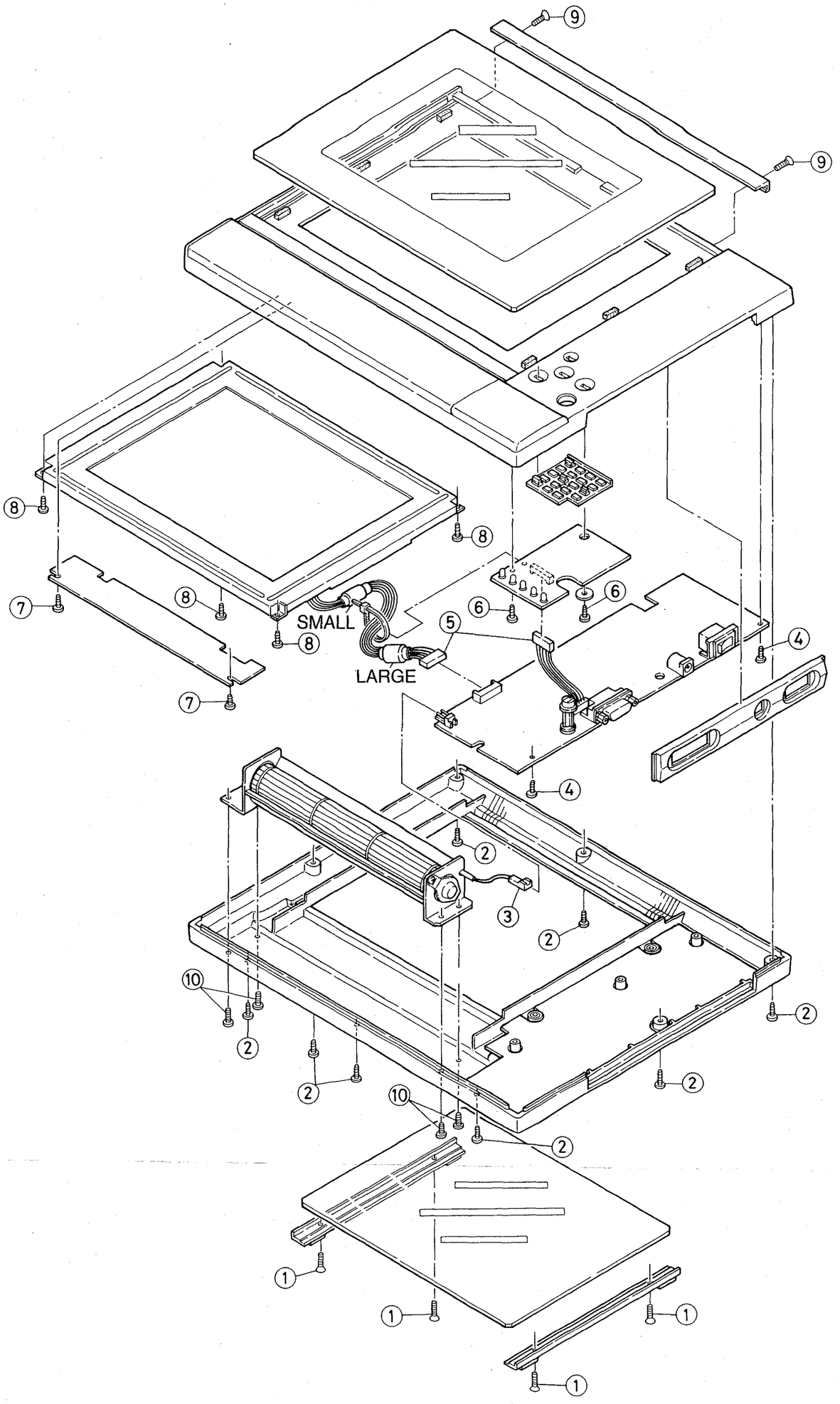


Fig. 36 PACKING OF THE SET



(1) Remove four screws ① holding the aluminium frames.
(2) Remove two aluminium frames and the glass.
(3) Remove eight screws ② holding the top and bottom cabinets.
(4) Separate the top and bottom cabinets and remove the plug ③ from the connector.
(5) Remove two screws ④ holding the main P.W.B. and lift up.
(6) Remove two cables ⑤ from the connectors and remove the main P.W.B.
(7) Remove two screws ⑥ holding the switch P.W.B. and remove it.
(8) Remove two screws ⑦ holding the angle and remove it.
(9) Remove four screws ⑧ holding the LCD unit and remove it.
(10) Remove two screws ⑨ holding the aluminium frame.
(11) Remove the aluminium frame and the glass.
(12) Remove four screws ⑩ holding the fan motor and remove it.

FOR SEEG SERVICE ENGINEERS

① This supplement manual contains following informations.

P.53 ~ 55 CIRCUIT DIAGRAM for SEEG version

P.56 P.W.B. PATTERN for SEEG version

P.57 ~ 63 REPLACEMENT PARTS LIST for SEEG version

② Please replace p.53 ~ 63 with this supplement manual, because MAIN P.W.B. of QA-1000 for SEEG version (DPWB-2056YAZZ) is different from other versions.

CIRCUIT DIAGRAM & P.W.B.

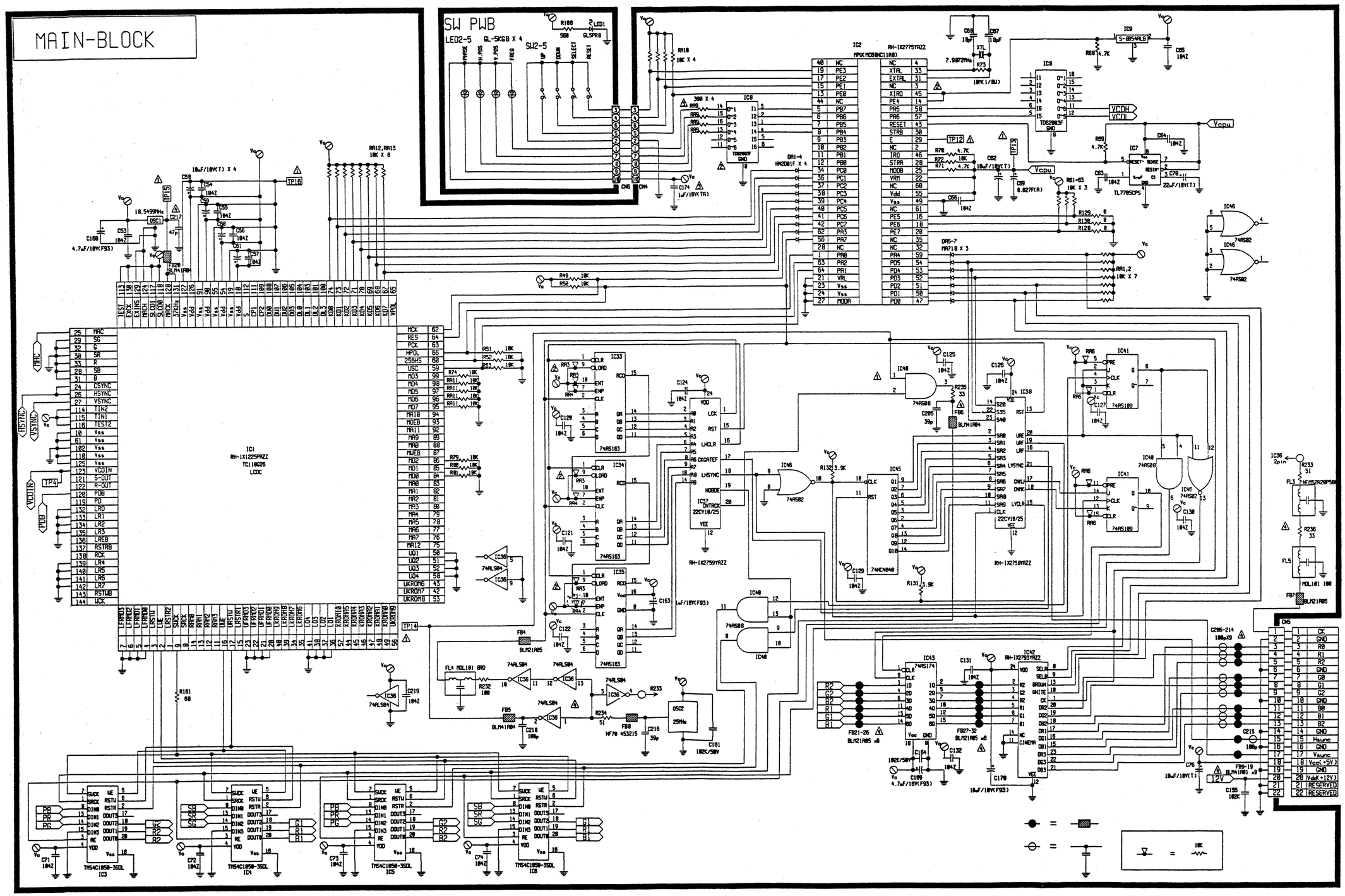


Fig. 31 CIRCUIT DIAGRAM (MAIN-BLOCK)

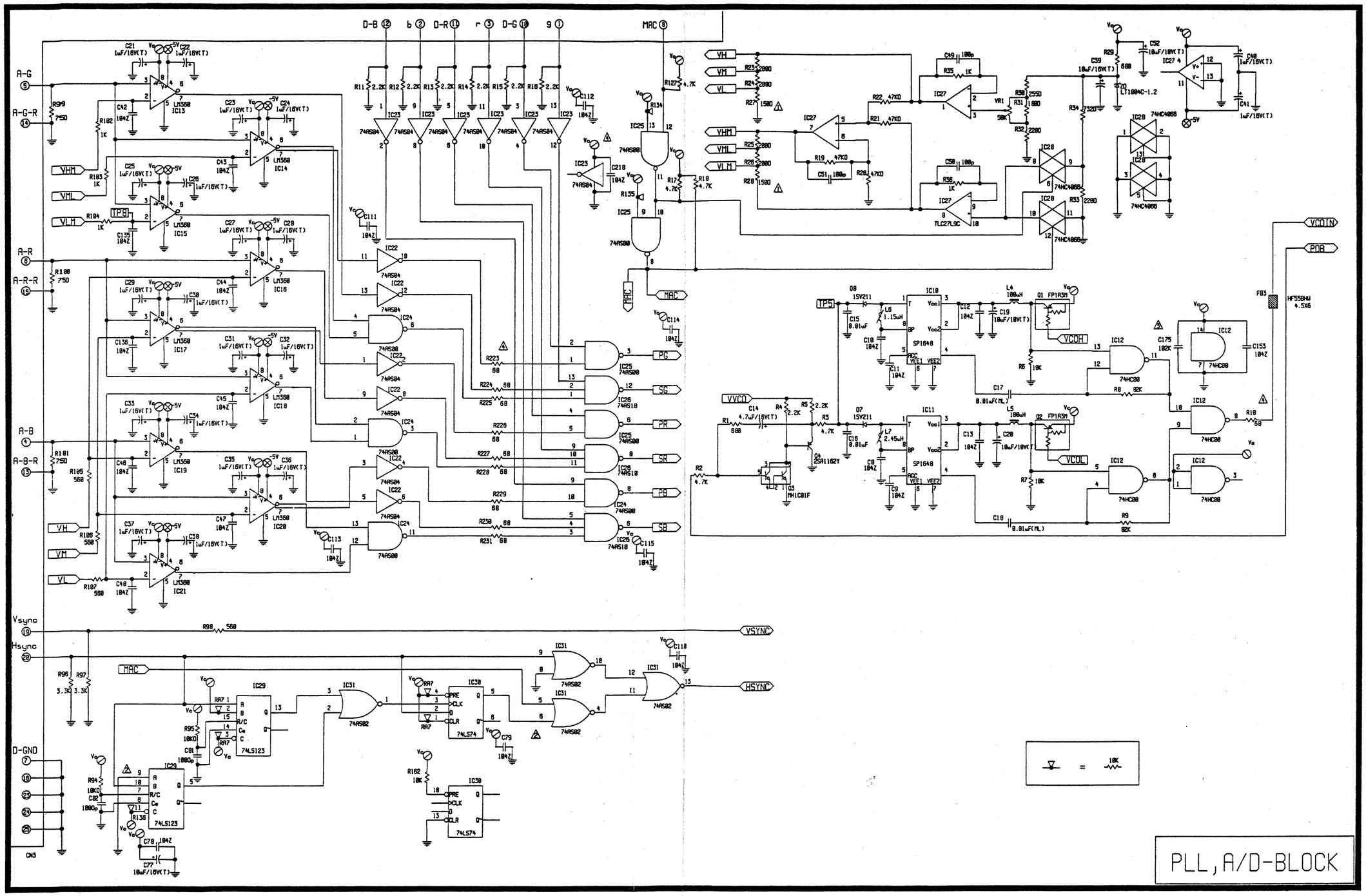


Fig. 32 CIRCUIT DIAGRAM (PLL, A/D-BLOCK)

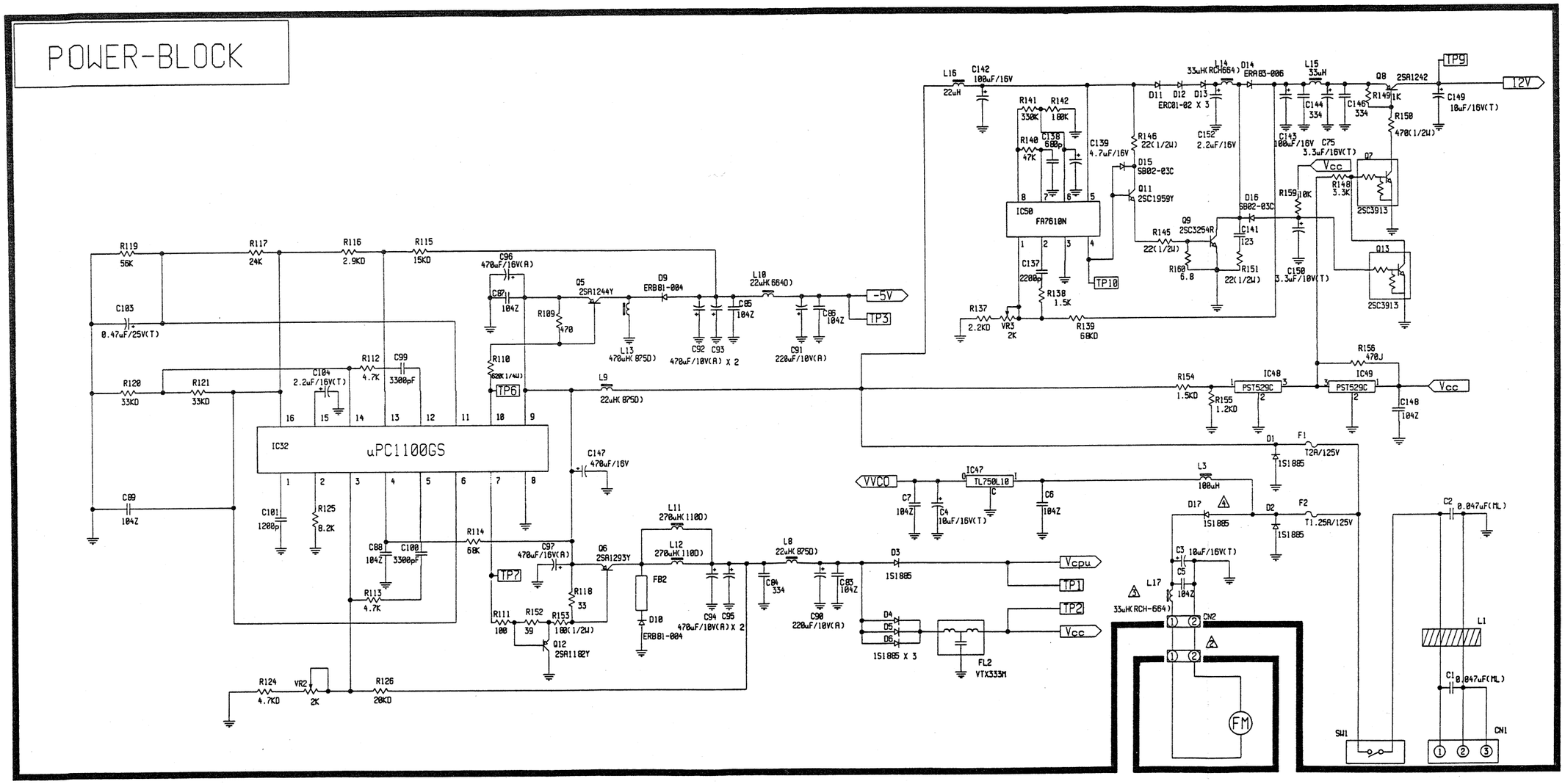
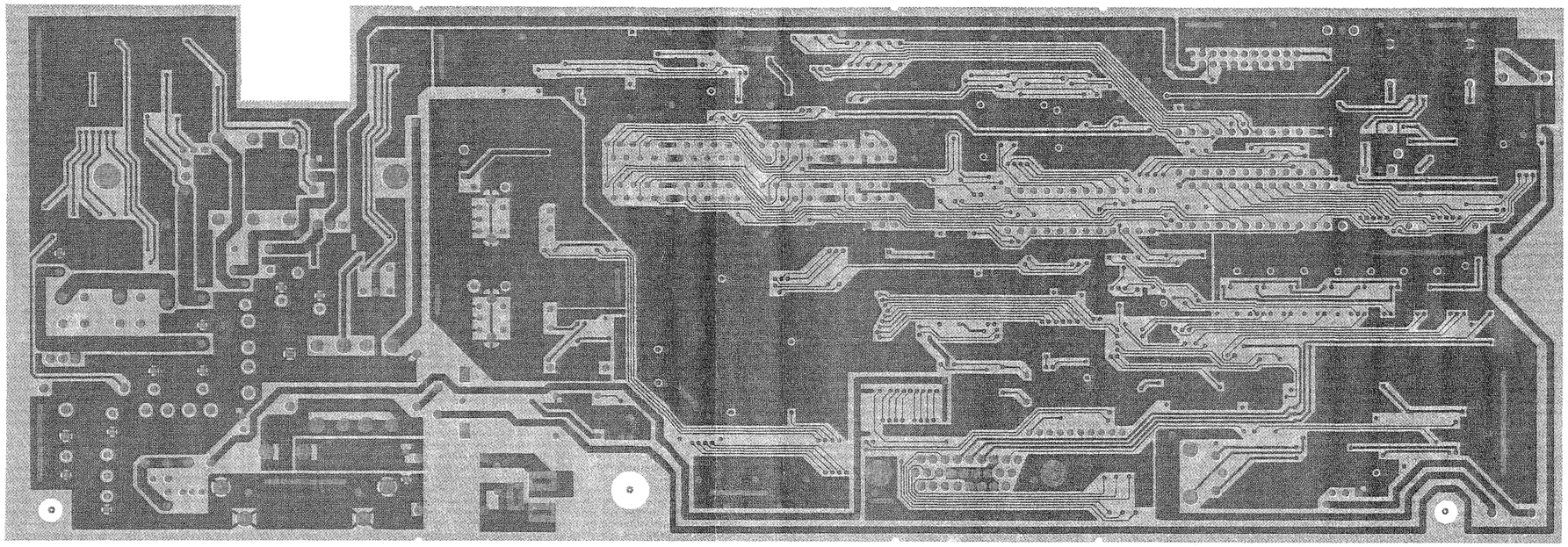


Fig. 33 CIRCUIT DIAGRAM (POWER-BLOCK)



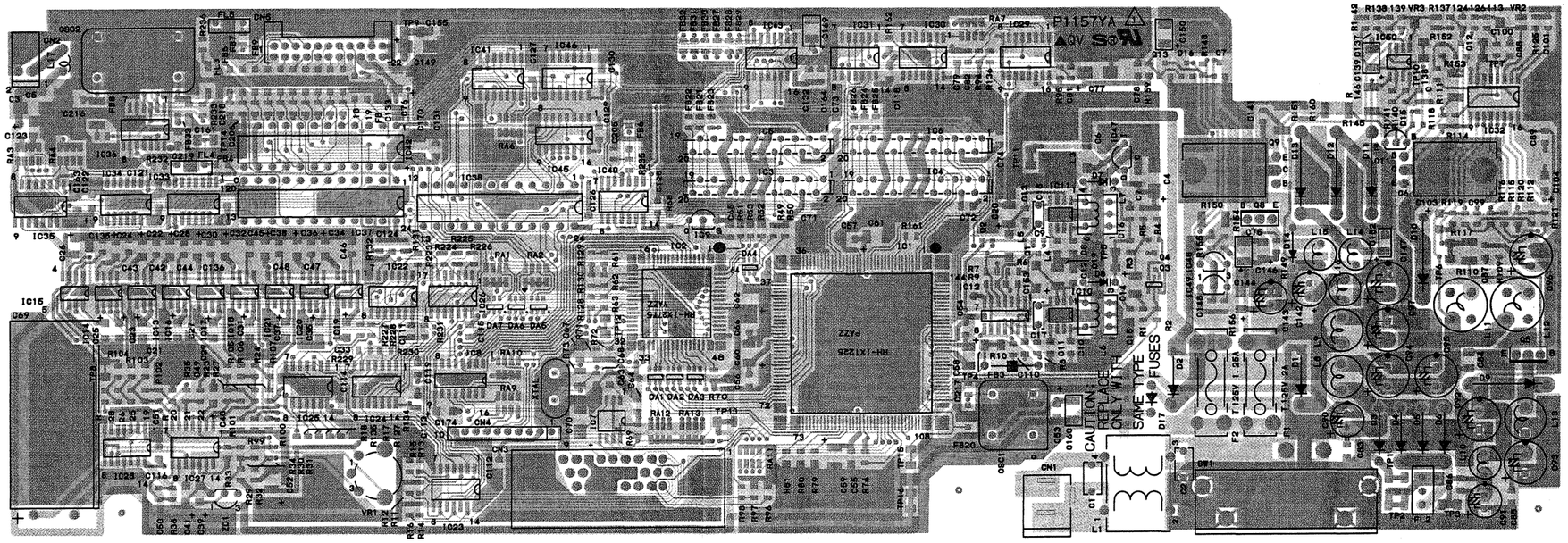


Fig. 34 P.W.B. PATTERN

REPLACEMENT PARTS LIST

"HOW TO ORDER REPLACEMENT PARTS"

To have your order filled promptly and correctly, please furnish the following information.

1. MODEL NUMBER
2. REF. NO.
3. PART NO.
4. DESCRIPTION

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
1. LCD, FAN						
1-1	LCD	DUNTL2072YAZZ	N	LCD UNIT (LQ10P01)	1	**
1-2	FAN	DFUNP0003YAZZ	N	FAN MOTOR	1	BL
2. IC						
2-1	IC1	RH-IX1225PAZZ		TC110G26	1	BL
2-2	IC2	RH-IX2775YAZZ	N	MC68HC11A8FU	1	AZ
2-3	IC3 ~ 6	RH-IX1232PAZZ		TMS4C1050-3SDL	4	BN
2-4	IC7	RH-IX0855PAZZ		TL7705CPS-B (T)	1	AL
2-5	IC8	RH-IX2765YAZZ	N	TD62003F (T)	1	AH
2-6	IC9	RH-IX0847PAZZ		S-8054ALB	1	AF
2-7	IC10, 11	RH-1X1235PAZZ		SP1648MPT (T)	2	AW
2-8	IC12	RH-IX1239PAZZ		MM74HC00M (T)	1	AD
2-9	IC13 ~ 21	RH-IX1238PAZZ		LM360M (T)	9	AM
2-10	IC22, 23	RH-IX1241PAZZ		SN74AS04NS (T)	2	AF
2-11	IC24, 25	RH-IX2766YAZZ	N	SN74AS00NS (T)	2	AE
2-12	IC26	RH-IX2767YAZZ	N	SN74AS10NS (T)	1	AF
2-13	IC27	RH-IX1236PAZZ		TLC27L9CNS (T)	1	AU
2-14	IC28	RH-IX1244PAZZ		μPD74HC4066G (T)	1	AF
2-15	IC29	RH-IX1284PAZZ		SN74LS123NS (T)	1	AF
2-16	IC30	RH-IX1133PAZZ		SN74LS74ANS (T)	1	AD
2-17	IC31, 46	RH-IX1285PAZZ		SN74AS02NS (T)	2	AE
2-18	IC32	RH-IX1234PAZZ		μPC1100GS (T)	1	AN
2-19	IC33 ~ 35	RH-IX2768YAZZ	N	SN74AS163NS (T)	3	AL
2-20	IC36	RH-IX2802YAZZ	N	SN74ALS04BNS	1	AE
2-21	IC37	RH-IX2759YAZZ	N	22CV10/25-PLD12	1	BA
2-22	IC38	RH-IX2758YAZZ	N	22CV10/25-PLD13	1	BA
2-23	IC40	RH-IX1240PAZZ		SN74AS08NS (T)	1	AF
2-24	IC41	RH-IX2771YAZZ	N	SN74AS109NS (T)	1	AH
2-25	IC42	RH-IX2793YAZZ	N	BPAL22V10ACNT-PLD11	1	BA

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
2-26	IC43	RH-IX2772YAZZ	N	SN74AS174NS (T)	1	AN
2-27	IC45	RH-IX2774YAZZ	N	μPD74HC4040G (T)	1	AG
2-28	IC47	RH-IX1233PAZZ		TL750L10CLP	1	AN
2-29	IC48, 49	RH-IX2788YAZZ	N	PST529C	2	AG
2-30	IC50	RH-IX2778YAZZ	N	FA7610N (T)	1	AL
3. Transistor						
3-1	Q1, 2	VSFP1A3M///-1		FP1A3M (T)	2	AC
3-2	Q3	VSHN1C01FY/-1		HN1C01F-Y (T)	1	AG
3-3	Q4	VC2SA1162SY-1		2SA1162Y (T)	1	AA
3-4	Q5	VS2SA1244Y/1E		2SA1244Y	1	AG
3-5	Q6	VS2SA1293Y/1E		2SA1293Y	1	AH
3-6	Q7, 13	VS2SC3913//-1	N	2SC3913 (T)	2	AB
3-7	Q8	VS2SA1242Y/-1	N	2SA1242Y	1	AE
3-8	Q9	VS2SC3254R/-1	N	2SC3254R	1	AF
3-9	Q11	VS2SC1959-Y-1	N	2SC1959Y	1	AB
3-10	Q12	VS2SA1182-Y-1	N	2SA1182Y (T)	1	AB
4. Diode						
4-1	D1 ~ 6, 17	VHD1S1885//-1		1S1885	7	AC
4-2	D7, 8	VHD1SV211//-1		1SV211	2	AC
4-3	D9, 10	VHDERB81-004/		ERB81-004	2	AF
4-4	D11 ~ 13	VHDERC01-02-1	N	ERC01-02	3	AC
4-5	D14	VHDERA83-006/	N	ERA83-006	1	AD
4-6	D15, 16	VHDSB0203C/-1	N	SB02-03C (T)	2	AB
4-7	ZD	VHELT1004CZ-1		LT1004CZ	1	AN
4-8	DA1 ~ 4	VHDHN2D01F/-1		NH2D01F (T)	4	AC
4-9	DA5 ~ 7	VHDMA718///-1	N	MA718 (T)	3	AD
4-10	LED1	RH-PX2134YAZZ	N	LED GL5PR8	1	AB
4-11	LED2 ~ 5	RH-PX2154YAZZ	N	LED GL5KG8	4	AB
5. Coil						
5-1	L1	RTRN0389PAZZ		FERRITE CORE	1	AL
5-2	L8, 9	RCILZ3877PAZZ		RCR-875D 22μH	2	AF
5-3	L3 ~ 5	VP-VD101K0000		LEM4532 (T)	3	AC

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
5-4	L6	RCILZ3874PAZZ		7KLT 1.15μH	1	AE
5-5	L7	RCILZ3875PAZZ		7KLT 2.45μH	1	AE
5-6	L10, 16	RCILZ3880PAZZ		RCR-6640D 22μH	2	AF
5-7	L11, 12	RCILZ2878PAZZ		RCR-110D 270μH	2	AF
5-8	L13	RCILZ2876PAZZ		RCR-875D 470μH	1	AF
5-9	L14, 15	RCILZ2105YAZZ	N	RCH-664 33μH	2	AD
6. Oscilator, Core, Filter						
6-1	OSC1	RCRSZ0041PAZZ		XTAL 18.5499MHz	1	AQ
6-2	OSC2	RCRS-2108YAZZ	N	DOC70 25.0000MHz	1	AU
6-3	XTL	RCRSZ0043PAZZ		XTAL 7.9872MHz	1	AH
6-4	FB2	RCORF0042PAZZ		FERRITE BEAD	1	AA
6-5	FB3	RCORF2005YAZZ	N	FERRITE BEAD	1	AC
6-6	FB4, 7, 21 ~ 32	RCORF2010YAZZ	N	BLM21A05	14	AE
6-7	FB5, 6, 20	RCORF2011YAZZ	N	BLM41A04	3	AE
6-8	FB8	RCORF2012YAZZ	N	HF70ACB453215	1	AE
6-9	FB9 ~ 19	RCORF2009YAZZ	N	BLM41A01	11	AE
6-10	FL1	RMPT-2044YAZZ	N	FILTER (VTX333M)	1	AE
6-11	FL3	RMPT-2048YAZZ	N	NFM52R20P506	1	AF
6-12	FL4	RMPT-2046YAZZ	N	MDL101100	1	AG
6-13	FL5	RMPT-2047YAZZ	N	MDL1018R0	1	AG
7. Fuse, Fuse Holder						
7-1	F1	QFS-F0003PAZZ	N	FUSE (125V/2.0A)	1	AD
7-2	F2	QFS-B0006PAZZ		FUSE (125V/1.25A)	1	AE
7-3		QFSHA2008YAZZ		FUSE HOLDER	4	AA
8. SW, VR						
8-1	SW1	QSW-C2088YAZZ	N	POWER SWITCH	1	AH
8-2	VR1	RVR-M0233PAZZ		VR 50K	1	AG
8-3	VR2, 3	RVR-M0232PAZZ		CHIP VR 2K	2	AC
9. Pulg, Connector						
9-1	CN1	QSOCZ0115PAZZ		DC JACK	1	AD
9-2	CN2	QPLGJ0010PAZZ		CONNECTOR (2P) FOR FAN	1	AC
9-3	CN3	QPLGZ0410PAZZ		D SUB CONNECTOR (26P)	1	AX
9-4	CN4	QCNCM2528YAZZ	N	CONNECTOR ASSEMBLY	1	AN
9-5	CN5	QPLGJ2683YAZZ	N	CONNECTOR (22P)	1	AM
9-6	CN6	QPLGZ0415PAZZ	N	CONNECTOR (10P)	1	AC

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
10. Resistor						
10-1	R1, 29	VRS-TW2AD681J		TW)1/10W-680J	2	AA
10-2	R2, 3, 17, 18, 68 ~ 71, 112, 113, 127	VRS-TW2AD472J		TW)1/10W-4.7KJ	11	AA
10-3	R4, 5, 11 ~ 16	VRS-TW2AD222J		TW)1/10W-2.2KJ	8	AA
10-4	R6, 7, 49 ~ 53, 61 ~ 63, 72, 74, 79 ~ 81, 133 ~ 136, 159, 162	VRS-TW2AD103J		TW)1/10W-10KJ	21	AA
10-5	R8, 9	VRS-TW2AD823J		TW)1/10W-82KJ	2	AA
10-6	R10, 161, 223 ~ 231	VRS-TW2AD680J		TW)1/10W-68J	11	AA
10-7	R19 ~ 22	RR-TV2AD4702D		TV)1/10W-47KD	4	AA
10-8	R23 ~ 26	RR-TW2AD2000D	N	TV)1/10W-200D	4	AA
10-9	R27, 28	RR-TV2AD1500D	N	TV)1/10W-150D	2	AA
10-10	R30	RR-TV2AD2550D	N	TV)1/10W-255D	1	AA
10-11	R31	RR-TV2AD1800D	N	TV)1/10W-180D	1	AA
10-12	R32, 33	RR-TV2AD2200D		TV)1/10W-220D	2	AA
10-13	R34	RR-TV2AD7320D		TV)1/10W-732D	1	AA
10-14	R35, 36, 102 ~ 104, 149	VRS-TW2AD102J		TW)1/10W-1KJ	6	AA
10-15	R73	VRS-TQ2BD106J		TQ)1/8W-10MJ	1	AA
10-16	R82	VRD-ST2DF120J		ST)1/5W-12J	1	AA
10-17	R92	VRS-TW2AD100J		TW)1/10W-10J	1	AA
10-18	R94, 95	RR-TV2AD1002D		TV)1/10W-10KD	2	AA
10-19	R96, 97, 148	VRS-TW2AD332J		TW)1/10W-3.3KJ	3	AA
10-20	R98, 105 ~ 107	VRS-TW2AD561J		TW)1/10W-560J	4	AA
10-21	R99 ~ 101	RR-TV2AD75R0D		TV)1/10W-75D	3	AA
10-22	R108	VRD-ST2DF561J	N	ST)1/5W-560J	1	AA
10-23	R109, 156	VRS-TW2AD471J		TW)1/10W-470J	2	AA
10-24	R110	VRS-TW2ED621J		TW)1/4W-620J	1	AA
10-25	R111, 232	VRS-TW2AD101J	N	TW)1/10W-100J	2	AA
10-26	R114	VRS-TW2AD683J		TW)1/10W-68KJ	1	AA
10-27	R115	RR-TV2AD1502D		TV)1/10W-15KD	1	AA
10-28	R116	RR-TV2AD2941D		TV)1/10W-2.94KD	1	AA

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
10-29	R117	VRS-TW2AD243J		TW)1/10W-24KJ	1	AA
10-30	R118, 235, 236	VRS-TW2AD330J		TW)1/10W-33J	3	AA
10-31	R119	VRS-TW2AD563J		TW)1/10W-56KJ	1	AA
10-32	R120, 121	RR-TV2AD3302D		TV)1/10W-33KD	2	AA
10-33	R124	RR-TV2AD4701D		TV)1/10W-4.7KD	1	AA
10-34	R125	VRS-TW2AD822J		TW)1/10W-8.2KJ	1	AA
10-35	R126	RR-TV2AD2002D		TV)1/10W-20KD	1	AA
10-36	R128, 129	VRS-TW2AD0000	N	TW)1/10W-0000	2	AA
10-37	R131, 132	VRS-TW2AD392J	N	TW)1/10W-3.9KJ	2	AA
10-38	R137	RR-TV2AD2201D	N	TW)1/10W-2.2KD	1	AA
10-39	R138	VRS-TW2AD152J	N	TW)1/10W-1.5KJ	1	AA
10-40	R139	RR-TV2AD6802D	N	TW)1/10W-68KD	1	AA
10-41	R140	VRS-TW2AD473J	N	TW)1/10W-47KJ	1	AA
10-42	R141	VRS-TW2AD334J	N	TW)1/10W-330KJ	1	AA
10-43	R142	VRS-TW2AD184J		TW)1/10W-180KJ	1	AA
10-44	R145, 146, 151	VRS-TW2HD220J	N	TW)1/2W-22J	3	AA
10-45	R150	VRS-TW2HD471J	N	TW)1/2W-470J	1	AA
10-46	R152	VRS-TW2AD390J	N	TW)1/10W-39J	1	AA
10-47	R153	VRS-TW2HD181J	N	TW)1/2W-180J	1	AA
10-48	R154	RR-TV2AD1501D	N	TV)1/10W-1.5KD	1	AA
10-49	R155	RR-TV2AD1201D	N	TV)1/10W-1.2KD	1	AA
10-50	R160	VRS-TW2AD6R8J	N	TW)1/10W-6.8J	1	AA
10-51	R234	VRS-TW2AD501J	N	TW)1/10W-51J	1	AA
10-52	RA1 ~ 4, 6, 7, 10 ~ 13	RR-KZ2195YAZZ	N	1/16W-10KJ	10	AB
10-53	RA9	RR-KZ2249YAZZ	N	1/16W-390J	1	AB
11. Capacitor						
11-1	C1, 2	RC-QZS473AFYK		FILM 0.047μF/K/50V	2	AF
11-2	C3, 4, 77, 149	VCSATD1CE106M		F93 10μF/16V	4	AD
11-3	C5 ~ 13, 42 ~ 48, 53 ~ 57, 63 ~ 66, 71 ~ 74, 78, 79, 83, 85 ~ 89, 110 ~ 127, 129 ~ 133, 135, 136, 148, 153, 219	VCKZTV1EF104Z		F/0.1μF/Z/25V	65	AA

ELECTRIC PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
11-4	C14, 139, 160, 169	VCSATH1CE475M		F93 4.7μF/16V	4	AC
11-5	C15, 16	VCKYTV1HB103K		CERAMIC B/0.01μF/K/50V	2	AB
11-6	C17, 18	RC-QZS103AFYK		FILM 0.01μF/K/50V	2	AF
11-7	C19, 20, 52, 58 ~ 62, 76, 170	VCSATH1AE106M		F93 10μV/10V	10	AD
11-8	C21 ~ 41, 163	VCSATD1CE105M		F93 1μF/16V	22	AB
11-9	C49 ~ 51, 206 ~ 214, 218	VCCCTV1H3101J		CERAMIC CH/100pF/J/50V	13	AA
11-10	C67, 68	VCCCTV1H3180J		CERAMIC CH/18pF/J/50V	2	AA
11-11	C69	RC-EZ0133PAZZ		JB 27mF/5.5V	1	AK
11-12	C70	VCSATH1AE226M		F93 22μF/10V	1	AD
11-13	C75, 150	VCSATD1CE335M	N	F93 3.3μF/16V	2	AC
11-14	C81, 82, 155, 161, 164	VCKYTV1HB102K		CERAMIC B/0.001μF/K/50V	5	AA
11-15	C84, 144, 146	VCKYTQ1EF334Z	N	F/0.33μF/Z/25V	3	AB
11-16	C90, 91	RC-EZ0186PAZZ		RS 220μF/10V	2	AB
11-17	C92 ~ 95	RC-EZ0185PAZZ		RS 470μF/10V	4	AC
11-18	C96, 97, 147	RC-EZ2578YAZZ	N	VR 470μF/16V	3	AC
11-19	C99, 100	VCKYTV1HB332K		B/3300pF/K/50V	2	AA
11-20	C101	VCKYTV1HB122K		B/1200pF/K/50V	1	AA
11-21	C103	VCSATD1EE474M		F93 0.47μF/25V	1	AC
11-22	C104, 152	VCSATH1CE225M		F93 2.2μF/16V	2	AC
11-23	C137	VCKYTV1HB222K	N	B/2200pF/K/50V	1	AA
11-24	C138	VCCCTV1H3681J	N	CH/680pF/J/50V	1	AB
11-25	C141	VCKYTV1HB123K	N	B/0.012μF/K/50V	1	AA
11-26	C142, 143	RC-EZ2577YAZZ	N	PL 100μF/16V	2	AC
11-27	C162	RC-SZA226M1A/	N	S89 22μF/10V	1	AE
11-28	C205, 216	VCCCTV1H3390J	N	CH/39pF/J/50V	1	AA
11-29	C215	VCKZPU1HB101K	N	CH/100pF/J/50V	1	AA
11-30	C217	VCCCTV1H3470J	N	CH/47pF/J/50V	1	AA
11-31	C232	VCTYPU1EF104Z	N	F/0.1μF/Z/25V	1	AA

CABINET PARTS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
12-1	Fig. 35-①	DCABA2003YASA	N	CABINET ASSEMBLY A	1	BR
12-2	②	DCABB2002YASA	N	CABINET ASSEMBLY B	1	BF
12-3	③	GWAKP2001YASA	N	OPERATION FRAME	1	AU
12-4	④	GCOVA2004YASA	N	SMOKED COVER	1	AQ
12-5	⑤	DFLM-2001YASA	N	ALUMINUM FRAME ASSEMBLY A	2	AX
12-6	⑥	LFRM-2003YASA	N	ALUMINUM FRAME C	1	AY
12-7	⑦	JBTN-0799PASA		KNOB FOR VR	1	AC
12-8	⑧	LANGK2030YAZZ	N	ANGLE	1	AD
12-9	⑨	MSPRP2001YASA	N	RUBBER KEY	1	AL
12-10	⑩	PGLSN2001YASA	N	GLASS A	1	BE
12-11	⑪	PGLSN2002YASA	N	GLASS B	1	AU
12-12	⑫	XYBSF30P10000		SCREW ϕ3 × 10S	10	AA
12-13	⑬	XYBSD30P08000		SCREW ϕ3 × 8S	9	AA
12-14	⑭	XBNSF30P08000	N	SCREW M3 × 8S	6	AA
12-15	⑮	XWBSF30P08000		SCREW M3 × 8S	4	AA
12-16	⑯	XWHSD35-10140	N	WASHER	1	AA
12-17	⑰	LX-WZ2003YAZZ	N	POLY SLIDER	1	AD
12-18	⑱	PSHEG2074YAZZ	N	INSULATION SHEET	1	AH
12-19		RCORF2014YAZZ	N	CRAMP CORE	1	AN
12-20		RCORF2013YAZZ	N	CRAMP CORE	1	AP
12-21		RCORF2015YAZZ	N	CRAMP CORE	1	AV

OTHERS

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
13-1		DADP-2001YAZZ	N	AC ADATOR	1	CA
13-2		DSOCZ2003YAZZ	N	9P RGB CABLE	1	BH
13-3		DSOCZ2002YAZZ	N	15P RGB CABLE	1	BN
13-4		DCNCM2001YAZZ	N	LCD CABLE (22P)	1	AZ
13-5		TLABZ2089YAZZ	N	AC ADAPTOR CAUTION LABEL	1	AD
13-6		TINSL2024YAZZ	N	OPERATION MANUAL (E, D, F, I)	1	AY
13-7		QACCV2001YAZZ	N	AC CODE	1	AX
13-8		PSPAK0040PAZZ		SPACER	1	AA

NOT REPLACEMENT ITEM

NO.	REF. NO.	PARTS CODE	NEW	DESCRIPTION	QTY	PRICE
14-1		DPWB-2056YAZZ	N	MAIN P.W.B. ASSEMBLY	1	**
14-2		DPWB-2055YAZZ	N	SWITCH P.W.B. ASSEMBLY	1	BS